NOAA Technical Memorandum NMFS-SEFC-62

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
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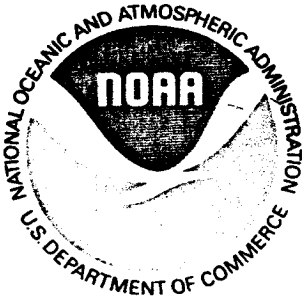

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James P. Walsh, Administrator
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Terry L. Leitzell, Assistant Administrator for Fisheries

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ABSTRACT

Data from over 54,000 king mackerel, Scomberomorus cavalla, were analyzed to evaluate temporal variations in size and sex composition in seven areas of the southeastern United States. Data were obtained from recreational hook-and-line fishermen of the coastal states from Texas to North Carolina, and from commercial hook-and-line and gill-net fishermen of south Florida.

Most of the length-frequency distributions derived from king mackerel catches were uni-modal. This distribution is typical of a species that spawns over a long period each year, has highly variable growth rates among individuals, or both.

Size composition in each area varied considerably between months and indicated temporally heterogeneous groups of king mackerel. Seasonal trends in size were at best weakly discernible. In Texas, where data were available from May to August, king mackerel tended to be larger in May and smaller in July; in Louisiana, where large fish were obtained throughout the year, the largest appeared to be more prevalent during the colder months; in northwest Florida, where data were available for the warmer months, fish at the beginning and end of the fishing season (May and September-November) appeared to be larger than those caught during mid-season; in south Florida, where data were available throughout the year, fish tended to be larger during spring and summer and smaller during winter; in North Carolina, where data were available from May to November, the fish appeared to be larger in the fall. There were strong tendencies for fish of similar sizes of each sex to occur together during specific time periods.

Females were dominant in the catches in all areas and years except south Florida in 1978. Annual or ranges of the annual estimates of percentage female by area were: Texas, 60.8 to 62.2%; Louisiana, 91.9 to 92.2%; northwest Florida, 57.1 to 75.1%; south Florida, 40.2 to 75.4%; and North Carolina, 75.8%. No explanation for these deviations from a 1:1 sex ratio was attempted. Distinct seasonal changes in sex ratio were observed only in Texas; females comprised the greatest proportion of the catch in the early months of each fishing season but, by August the sex ratio had approached 1:1.

INTRODUCTION

The king mackerel, Scomberomorus cavalla, is one of the most important species in the coastal pelagic fisheries of the southeastern United States. In spite of its high commercial and recreational value (Wise and Thompson 1977, Deuel and Clark 1968), many details pertaining to king mackerel catches and population structure are not available. We present in this paper information about the size composition and sex ratio of king mackerel in relation to area and time of year.

STUDY AREA AND METHODS

King mackerel were sampled from commercial or recreational landings in seven locations (Figure 1). King mackerel were caught by: recreational hook and line in each area; commercial snapper hook and line off Mississippi; commercial gill net off south Florida; and commercial king mackerel hook and line off south Florida and North Carolina.

Methods used by recreational fishermen to catch king mackerel vary among areas. Off Texas, the Atlantic cutlassfish, Trichiurus lepturus, is usually used as bait and ranges from 30 to 45 cm in length. It is attached to a forward and trailing hook and is trolled or drifted. Off Louisiana a wide assortment of baits and artificial lures are used when trolling but most large king mackerel are caught by drifting live sand seatrout, Cynoscion arenarius, or Atlantic croaker, Micropogonias undulatus, beside or beneath oil rigs located in water depths from 12 to 45 m. The baits are large and usually range from 0.2 to 0.7 kg. Off northwest Florida, round scad, Decapturus punctatus, are almost always used for bait and are attached to single, double, or treble hooks. These baits are from 15 to 25 cm long and are trolled at slow speed or drifted. Several methods are used to capture king mackerel off the coasts of Georgia, South Carolina, and North Carolina by recreational anglers (Manooch 1979). Anglers fish for king mackerel from charter boats, party or headboats, large and small private boats, piers, bridges, and occasionally from the surf. Three basic techniques are used to catch this species. Fishermen aboard boats often troll at or below the surface using spoons and feathered jigs with or without attached strips of mullet, Mugil cephalus. Trolling is usually done in a haphazard fashion until fish are hooked, and then the boats circle until the catch rate diminishes. Another technique is casting at schools of mackerel from a fixed platform or boat and retrieving the baits with a jerking motion. The third technique is float fishing usually done from a drifting or anchored boat; hooks are baited with live fish and are suspended 3.0 to 4.6 m below a float on the surface.

King mackerel from commercial snapper boats were caught incidentally to demersal fishes. Standard bottom rigs with three to six hooks baited with pieces of fish or squid were used. The king mackerel were caught in an area east of the mouth of the Mississippi River where water depths were between 50 and 130 m.

The king mackerel landed by commercial fishermen in south Florida are caught by runaround gill nets and by hook and line (Beaumariage 1973; Austin, Browder, Brugger, and Davis 1978; Manooch 1979). The nets are 120-220 m long,

about 22 m (200 meshes) deep, and have a stretched-mesh of 12.1 cm. The nets are fished in water depths as deep as 21 m. Spotter aircraft are frequently used to assist fishermen in locating schools of fish and to direct the setting of nets. In the commercial hook-and-line fishery, lines with spoons or feathered jigs, sometimes with strips of mullet or squid, are trolled behind boats and are retrieved manually or with hydraulic or electric reels. Planers or weights are often used to fish the lures deep (Harris 1974).

Length and sex data on king mackerel were obtained by personnel of the Florida Department of Natural Resources and of the National Marine Fisheries Service. Data were summarized by numbers of fish in relation to sex, location, capture gear, and time (Tables 1 and 2).

Length measurements were taken from uncut, gutted, or filleted fish. Fork length was measured from the tip of the snout (mouth closed) to the fork of the tail to the nearest millimeter or 0.1 in. Measurements in inches were later converted to millimeters.

Length data were grouped into 100 mm intervals and categorized by location, year, month, gear, and sex if determined (Appendix Tables 1-7). All resultant length-frequency distributions representing 25 or more fish were compared between months for each area. Chi-square tests were used to compare homogeneity of frequency distributions and to compare sex ratios to a hypothesized 1:1 ratio (Simpson, Roe, and Lewontin 1960, p 194 and 326).

SEASONAL CHANGES IN SIZE AND SEX RATIO

We assumed that changes through time in the size and sex composition of the fished population or stock in a particular area would be reflected in local catches. On this basis we analyzed length-frequency distributions and sex ratios of catches for each area and for each gear within an area.

Texas - Length distributions of king mackerel caught by recreational fishermen from Texas were uni-modal during each month with greatest modal lengths during May or June (Figure 2). The length composition changed significantly between consecutive months each year except June-July 1977 (Table 3).

Mean lengths of king mackerel of each sex were smallest during July except for females during 1977 (Figure 3). In 1977 the females were similar in size in June-July but smaller than those caught in August.

Sex ratios deviated significantly in favor of females during one of the three months in 1977 and three of four months in 1978 (Table 4). Females comprised the greatest proportion of the catch in the early months of each season, but by August their proportions were similar to those of males (Figure 4).

Sex ratios for each year, when analyzed by size class of fish, showed males dominant in only the smallest size class (500-699 mm FL) during one year (1978) (Table 5). Females comprised over 75% of the catch in size classes above 899 mm FL.

Louisiana - Length distributions of king mackerel show that large (over 1,299 mm FL) fish were caught by recreational fishermen during all seasons in the Louisiana area (Figure 5). The largest fish (over 1,399 mm FL) were caught in highest proportions from November through March. Small fish (less than 700 mm FL) were caught only during one month (June 1977) of the two-year period. Size composition changed significantly between months (not consecutive months necessarily) in 8 of the 13 comparisons (Table 3).

Mean lengths of king mackerel of each sex showed generally similar trends during each year (Figure 3). especially when considering the small sample sizes for males (Table 6). With the exception of January 1978, mean lengths tended to be highest during colder months and lowest during warmer months.

Females were dominant in the catches during every month that samples were taken (Figure 4) and in every size class for both years (Table 5); sex ratios ranged between 80 and 100% females. The proportions of males in the catch were greatest from May through September.

Mississippi - Samples of king mackerel were obtained off the Mississippi coast from recreational and commercial snapper fishermen, but the number of king mackerel (22) sampled from the recreational fishery was too small for seasonal analysis (Table 6).

The average length of king mackerel that were caught by commercial snapper fishermen was larger in 1977 than in 1978 (Figure 6). In 1978 modal lengths were smaller in June than in July and August. Mean lengths of king mackerel were greatest for males in July and for females in August (Figure 3), except for a single large female caught in September (Table 6). These fish, taken from water depths much greater than those in the other sampling areas, averaged larger during warmer months.

Sex ratios showed a high proportion of females for the recreationally caught fish and during June through August for the commercially caught fish (Figure 4). Females dominated each size class except the 500-699 mm FL class (Table 5) in 1978.

Northwest Florida - Length distributions of king mackerel caught by recreational fishermen from northwest Florida during 1968-69 and 1977-78 indicated that the populations were composed of more large fish in the early part (April-July) of each season (Figures 7-9). In 1978, fish less than 600 mm FL dominated every month except June. The size compositions changed significantly between months in 14 of 21 comparisons (Table 3).

Monthly mean lengths of king mackerel of each sex tended to vary similarly. They were lowest during July, August, or September (Table 7 and Figure 3).

Twenty-six monthly estimates of sex ratio were made. Ratios deviated significantly in favor of females in 17 months and in favor of males in two months (October 1977 and August 1978) (Table 7). Highest proportions of

females occurred in July or August of each year except 1978. In 1978 the proportion of females was lowest in August (Figure 4).

Females were dominant in all size classes during each year except for the smallest size group (300-399 mm FL) in 1978 (Table 5).

South Florida - The most extensive sampling among the geographic areas occurred in south Florida. Data were obtained from recreational and commercial hook-and-line and gill-net fisheries. Summary data for these samples are provided in Tables 8 and 9.

Data from recreational fishermen were obtained for three months during 1979. Catches were composed of larger fish in January than in February or March (Figure 10). Large proportions of the fish caught in February and March were less than 700 mm FL. Size composition varied significantly between months (Table 3). Mean lengths decreased from January through March (Table 9). No sex ratio data were available.

Data from commercial hook-and-line catches were available for 1968-69 and 1975-79. Data from at least two months during each of the seven years (Figures 11-16) were obtained. No general seasonal pattern in size composition among all years was apparent. For each year, the greatest monthly modal lengths occurred as follows: 1968 - April and May; 1969 - July, August, and November; 1975 - all months except March; 1976 - April; 1977 - December; 1978 - May; 1979 - March. The frequency distributions changed significantly between months in 23 of the 38 comparisons (Table 3). Mean lengths of each sex tended to increase or decrease between months in a similar fashion except in July-August 1969 (Figure 3). Mean lengths (sexes combined) were plotted by year and for all years combined for the commercial hook-and-line data in an attempt to determine seasonal changes in size. The data indicated that mean lengths averaged less during colder than during warmer months (Figure 17). The averaged monthly means from the commercial hook-and-line data indicated that the average size of the fish increased from late winter, was highest during the spring and summer, and decreased in the fall (Figure 18). Sex ratios deviated significantly in 12 of 21 months (Table 8) but did not change according to any apparent seasonal pattern (Figure 4). Females were dominant in 18 of the 21 months and 10 of the 12 months when differences were significant. Only during May 1969 and September 1978 were males in significantly higher proportions than females. Sex ratios, when analyzed by size class and year, showed males dominant in two of four comparisons in the 500-699 mm FL class and in one of four comparisons in the 700-899 mm FL class (Table 5). In size classes above 899 mm FL, females comprised over 67% of the catch and were dominant in each size class for all four years. Data from gill-net fishing were obtained for various months in 1968-69 and 1976-78. Modal lengths of king mackerel caught in gill nets were the same for all months and years (Figure 19). Fish under 600 mm FL were not caught. Much variation did occur among months, however, in the percents of larger fish caught by the gill nets. Significant differences in size composition between all months resulted (Table 3). Mean lengths were less in April than in January during 1968 and 1977, but much variation occurred in mean lengths in intervening months (Figure 17). Mean lengths of each sex tended to vary similarly during 1968 (Figure 3). Females were in greater proportions than

males during all months and in significantly greater proportions during four of the seven months (Table 8). The proportion of females was greatest in April (Figure 4). Most (75.7%) of the fish that were 500-699 mm FL during 1968 were males, but females predominated in the other size groups (Table 5).

South Carolina - Georgia - Sufficient amounts of data for analysis were available for only three months (Table 10). Catches by recreational fishermen were composed of significantly smaller fish in October than in September (Table 3, Figure 20). Significantly more females than males were landed in October, the only month in which a large number of samples were obtained (Table 10). Overall, females dominated in every size group (Table 5).

North Carolina - Data were available for 1977-78 from catches by recreational fishermen (Table 10). Modal lengths of king mackerel that were caught by recreational fishermen increased from May to June in 1977 and decreased from May to June in 1978 (Figure 20). Modal lengths were the same in three of the four months for which length-frequencies were analyzed in 1978. Length-frequency distributions varied significantly between June and September and between September and October 1978 (Table 3). Mean lengths of each sex varied in a generally similar pattern and were greater in October or November than in May (Figure 3). Females only were caught in November, but they averaged much larger than either sex in previous months. Sex ratios deviated significantly in favor of females during seven of the eight months for which data were available (Table 10), and the ratio varied from 71.3 to 100% female between months (Figure 4). Females were dominant in all size classes in 1978 (Table 5).

Length data from the commercial hook-and-line fishery in North Carolina were available for September and October of 1978 and for May 1979 (Table 10). Modal lengths were the same in September and October 1978 (Figure 20); mean fork length increased from 804 to 836 mm. The distributions did not vary significantly between months (Table 3). Sex data were not available.

DISCUSSION AND SUMMARY

The king mackerel in this study were caught by recreational hook and line, commercial hook and line, and gill net. Among these gears, as they were used, the gill net was the most selective and the recreational hook and line was the least selective toward particular sizes of king mackerel. When all monthly data from south Florida are viewed, the modal lengths varied from 649 to 849 mm FL in commercial hook and line (Figures 11-16) but were always 749 mm in the gill-net catches (Figure 19). Modal lengths from recreational hook-and-line catches varied the most (Figure 10); they ranged from 649 to 949 mm FL within a three-month period.

Size compositions of king mackerel varied considerably between months in each area and indicated temporally heterogeneous groups. Monthly length-frequency distributions revealed significant changes in size composition between months in 49 of 92 comparisons. Sizes of males and females tended to increase or decrease similarly from month to month.

In areas along the northern Gulf of Mexico, patterns of seasonal change in size of king mackerel were similar. Mean sizes of king mackerel along northwest Florida were highest in spring and fall and lowest during July or August of each year. Mean sizes were also lowest during the warmer months in Louisiana and Texas and, although the data were meager, seasonal changes in size in Texas appeared to be similar to those in northwest Florida.

In south Florida seasonal changes in size based on commercial hook-and-line data were at best only weakly discernible. During most years mean lengths tended to be highest during warmer months. When the monthly means from different years were averaged the lengths were: April-June, 808 mm; July-September, 816 mm; October-December, 768 mm; and January-March, 758 mm.

Seasonal changes in size of king mackerel along the south Atlantic coast could not be defined with any certainty because of the paucity of data. In North Carolina mean lengths of recreationally caught fish increased from May (682 mm) to June (735 mm) 1977, decreased from May (809 mm) to June (789 mm) 1978 and increased from September (844 mm) to October (856 mm) 1978. Fish that were caught by commercial hook and line also increased from September (804 mm) to October (836 mm) 1978 in North Carolina. In South Carolina the recreationally caught fish decreased from 895 mm in September to 811 mm in October 1978.

Females were dominant in the catches with few exceptions. In Louisiana annual estimates of percent female were 91.9 in 1977 and 92.9 in 1978. In other parts of the northern gulf and along North Carolina, South Carolina, and Georgia the annual estimates of percent female ranged from 57.1 to 75.8. Only in south Florida did the sex ratio favor males, and this occurred only during 1978 when the annual estimate based on commercial hook-and-line data was 40.2% female.

The degree of dominance by female king mackerel varied in relation to size of fish and type of gear used to capture the fish. Females were always dominant in size classes $\geq$ 700 mm FL except for hook-and-line catches in south Florida in 1978 (females represented only 34.9% of the catch for fish between 700-899 mm FL). In the 500-699 mm FL class, percent females were: 47.1 and 41.8 in 1977-78 in Texas; 100 in 1977 in Louisiana; from 57.0 to 73.3 during 1968-78 in northwest Florida; from 35.6 to 58.2 based on commercial hook-and-line data during 1968-79 and 24.3 based on gill-net data in 1968 in south Florida; 57.8 in 1978 in South Carolina-Georgia; and 61.9 in 1978 in North Carolina. With one exception only small numbers of samples with few individuals per sample were available to evaluate sex ratio in the 300-499 mm FL class. The numbers of males and females respectively, observed in northwest Florida were 1 and 3 in 1968, 0 and 2 in 1969, 0 and 3 in 1977, and 138 and 66 in 1978; in south Florida the numbers were 0 and 1 in 1968, 0 and 1 in 1969, and 0 and 1 in 1979.

In summary, much variation was found in size composition and sex ratio between months and between areas. Seasonal patterns in size variation, however, were similar in the three areas of the northern Gulf of Mexico. Females dominated the catches in all areas and all years except for south Florida in 1978.

ACKNOWLEDGMENTS

Sincere appreciation is extended to the commercial and recreational fishermen and members of sport-fishing organizations who contributed samples, time, and information for this paper. We are especially indebted to Messrs. Raymond Groom, Jinx Martin, Dickie Myers and personnel of the Louisiana Wildlife and Fisheries Commission.

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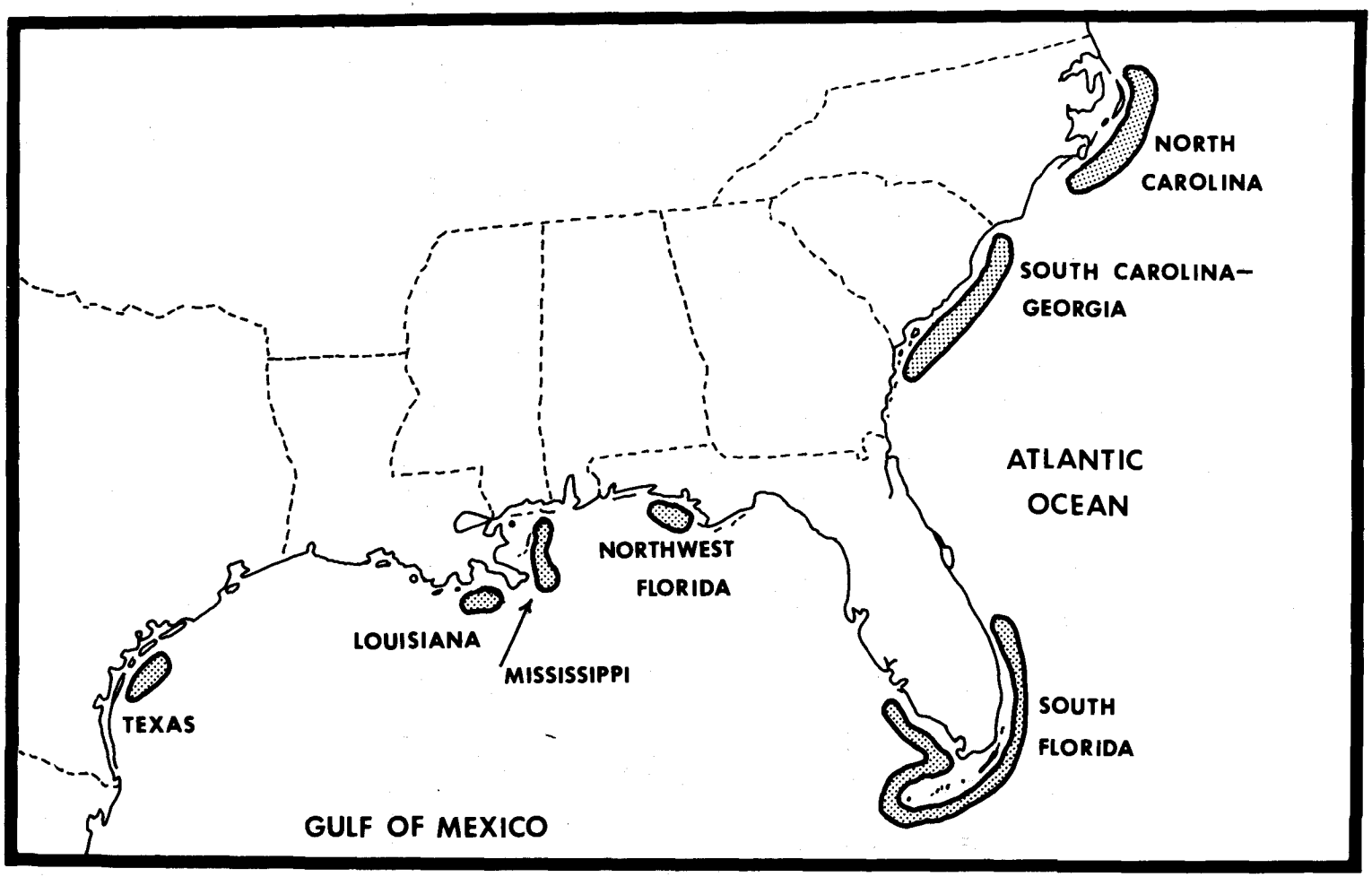

Figure 1. Sampling locations in the southeastern United States.

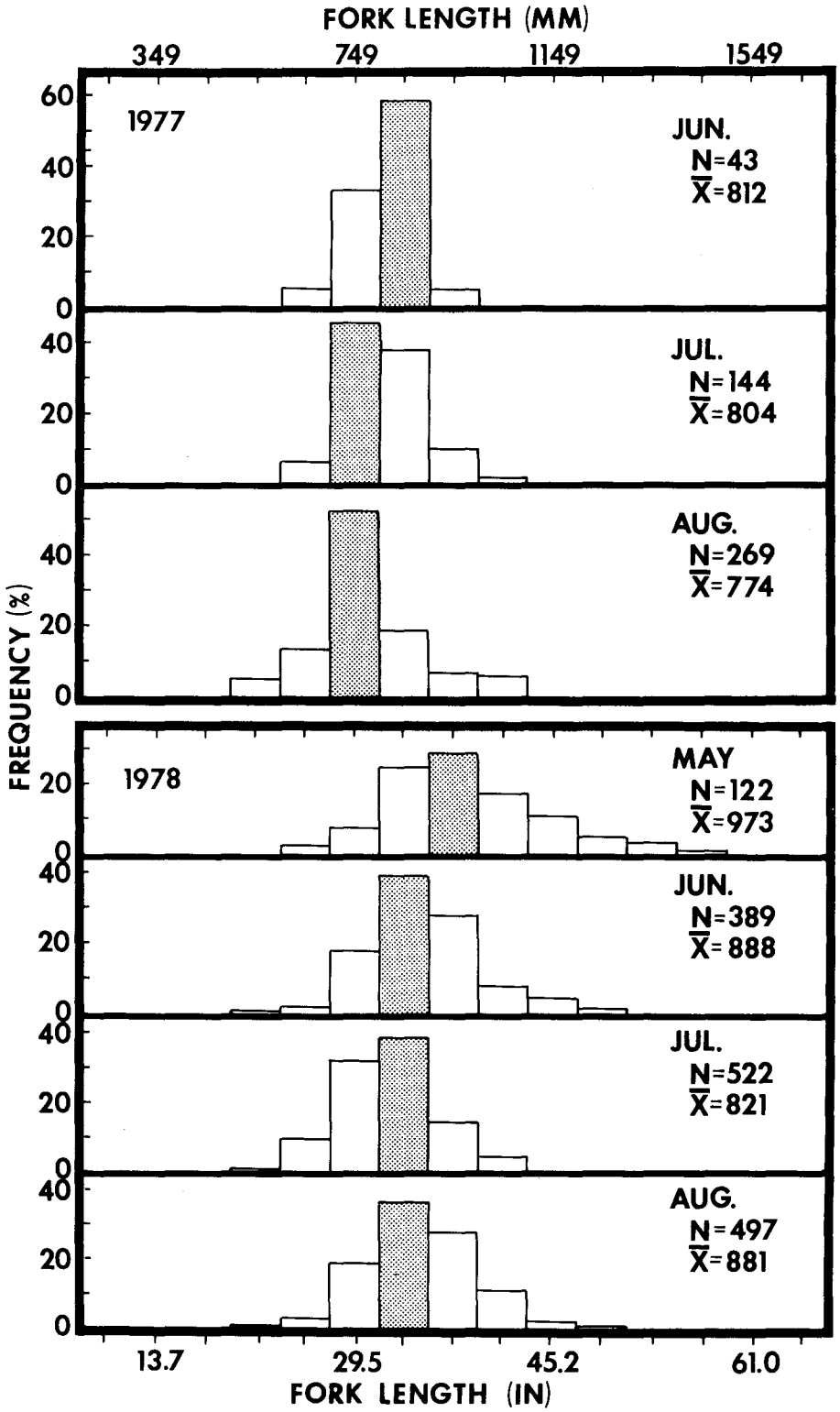

Figure 2. Texas: Length-frequency distributions of king mackerel caught by recreational fishermen in 1977-78.

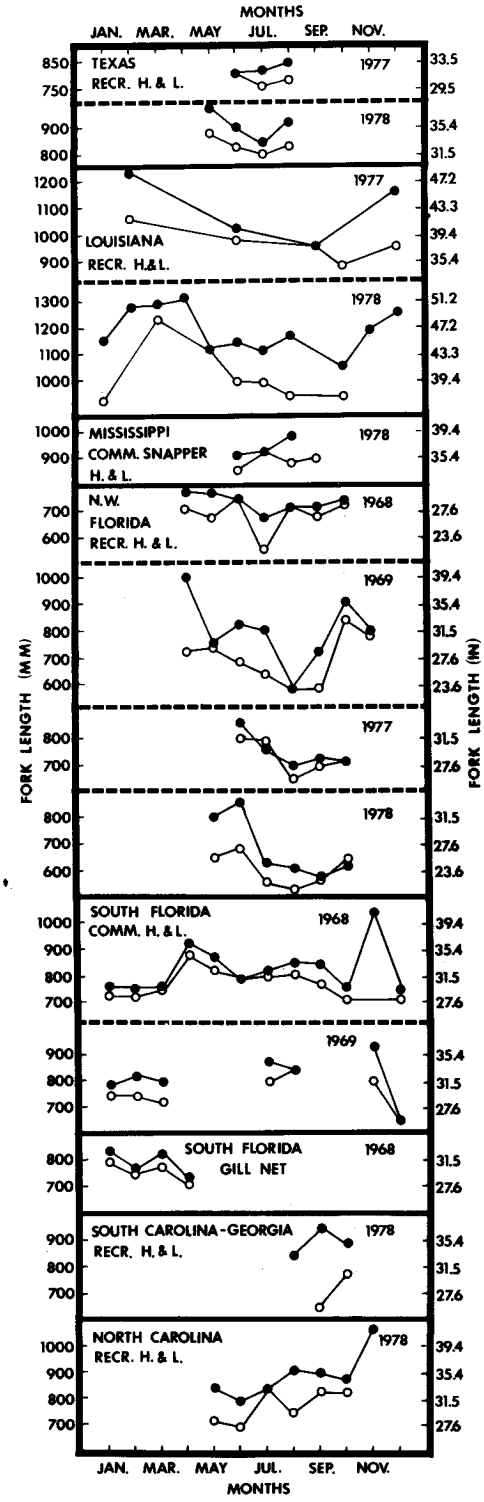

Figure 3. Mean fork length of king mackerel by month, sex, area, type of gear, and year. Solid circles = females; open circles = males.

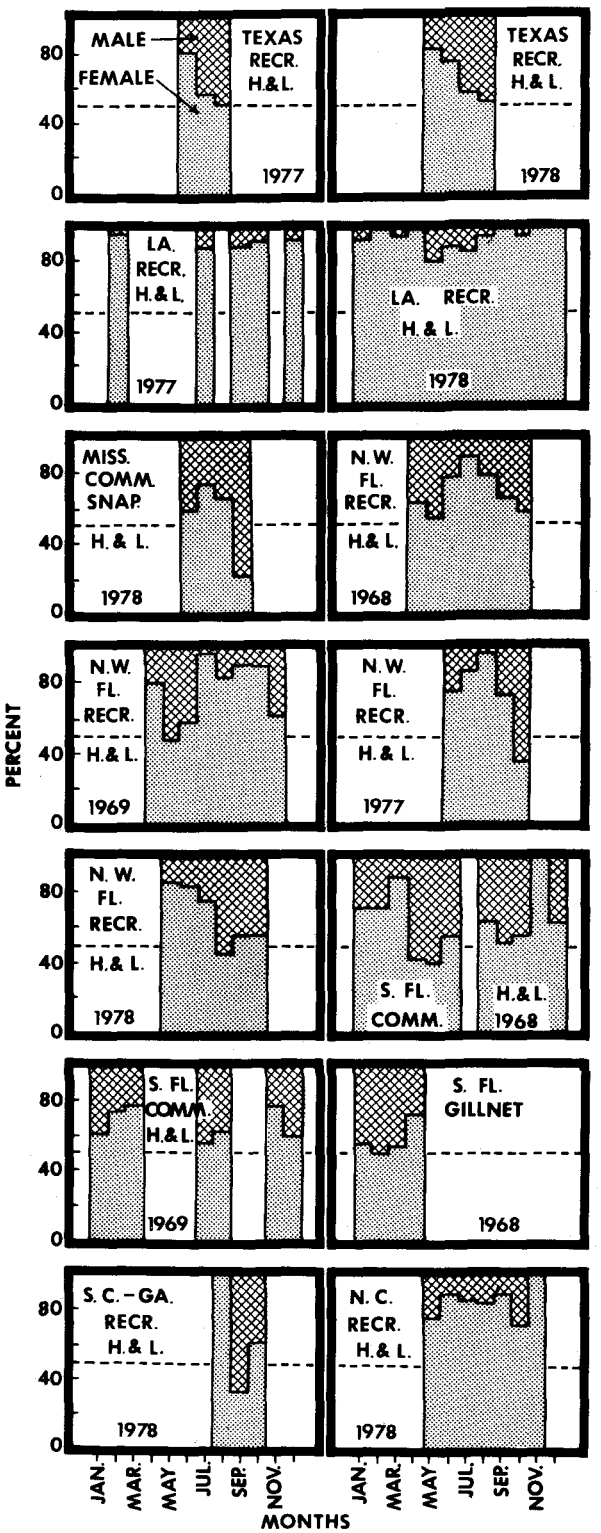

Figure 4. Percents of each sex of king mackerel by month, area, type of gear, and year.

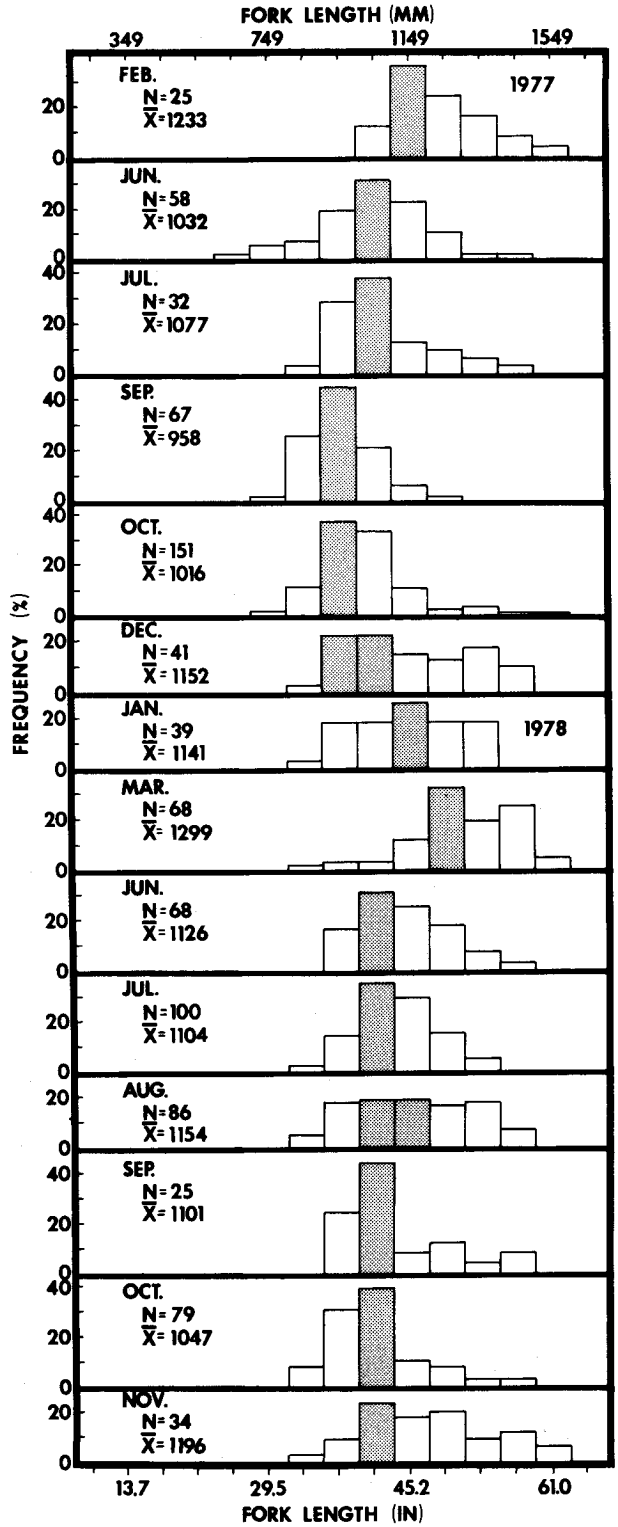

Figure 5. Louisiana: Length-frequency distributions of king mackerel caught by recreational fishermen in 1977-78.

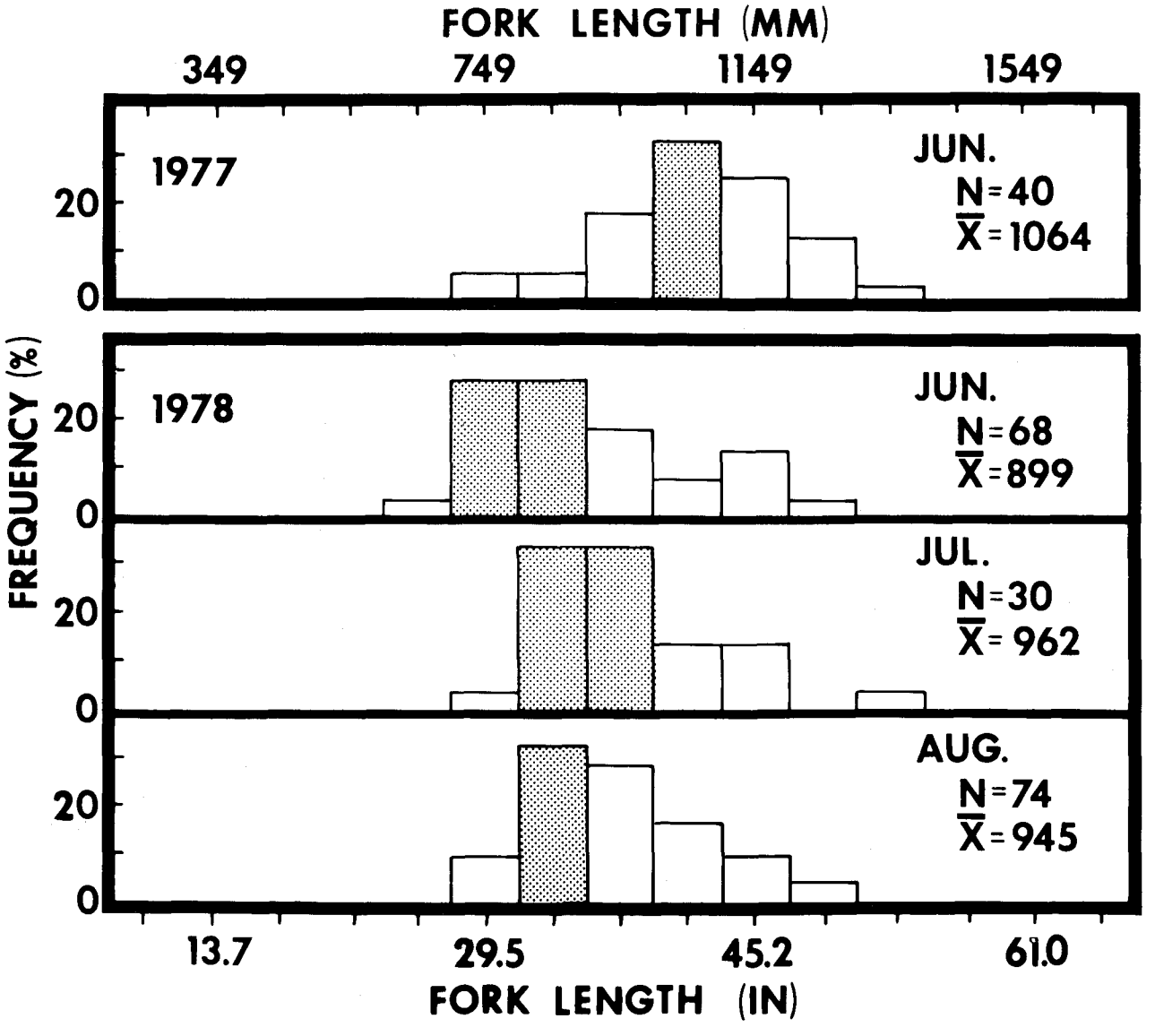

Figure 6. Mississippi: Length-frequency distributions of king mackerel caught by commercial snapper fishermen in 1977-78.

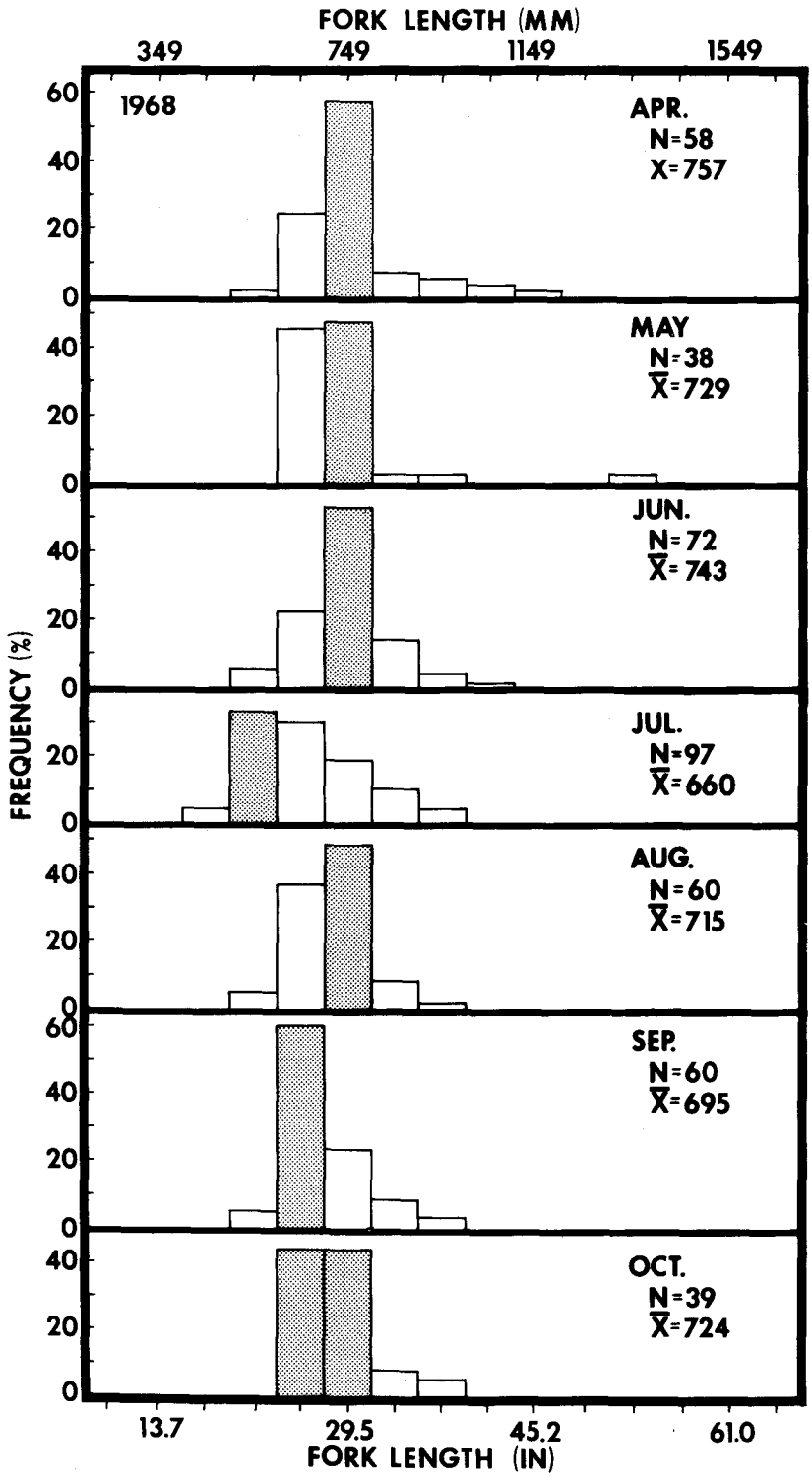

Figure 7. Northwest Florida: Length-frequency distributions of king mackerel caught by recreational fishermen in 1968.

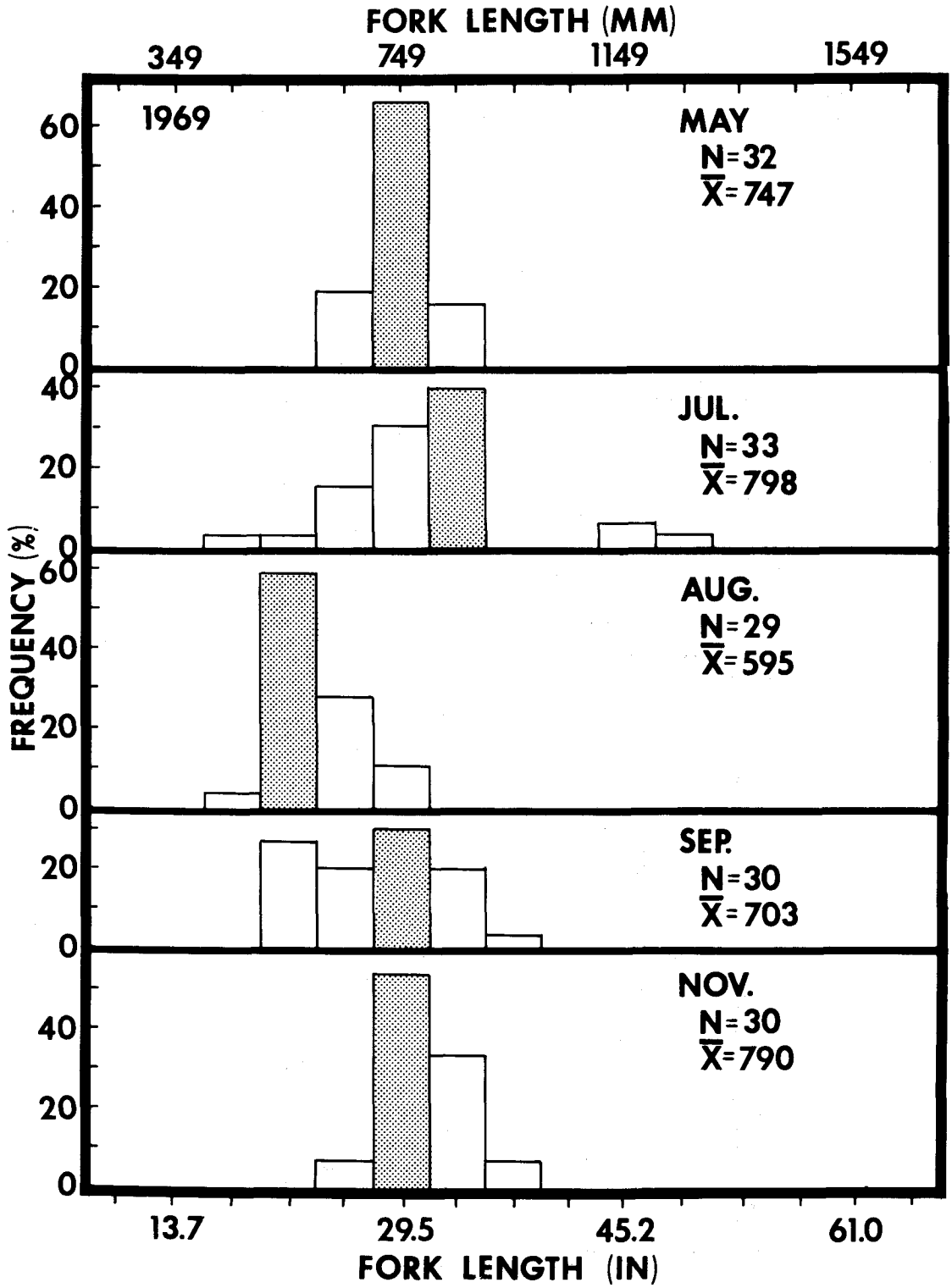

Figure 8. Northwest Florida: Length-frequency distributions of king mackerel caught by recreational fishermen in 1969.

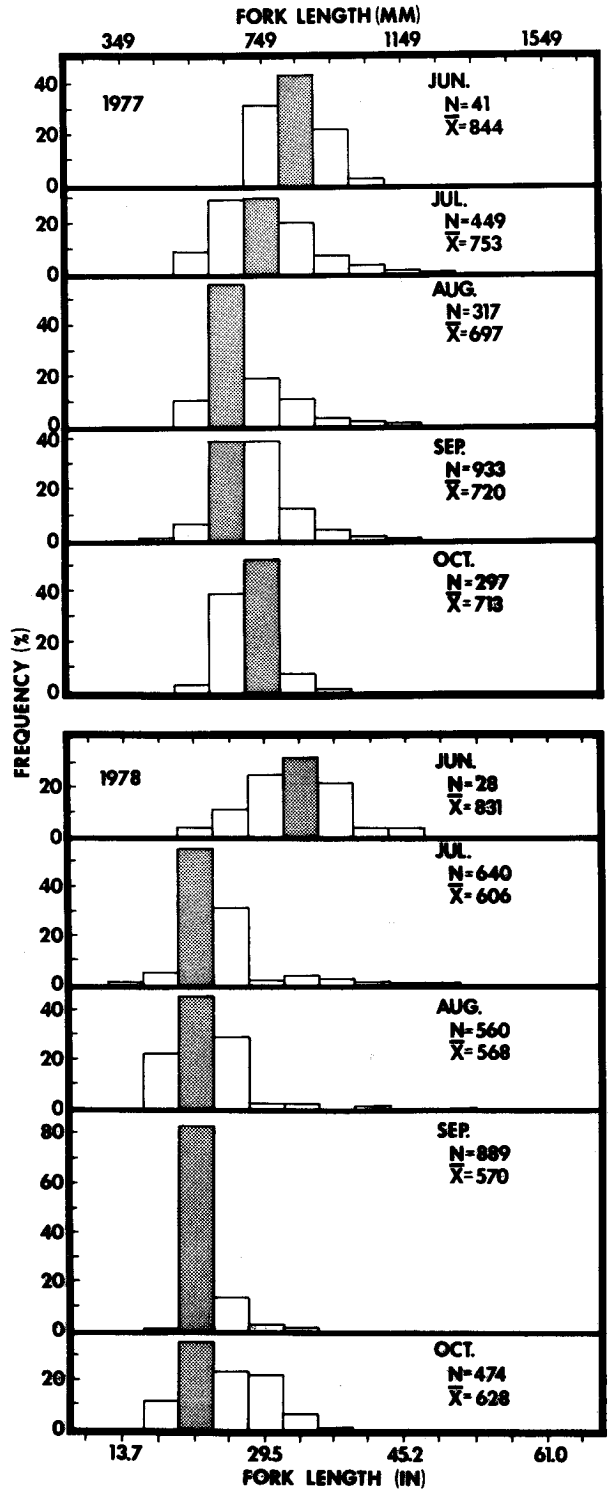

Figure 9. Northwest Florida: Length-frequency distributions of king mackerel caught by recreational fishermen in 1977-78.

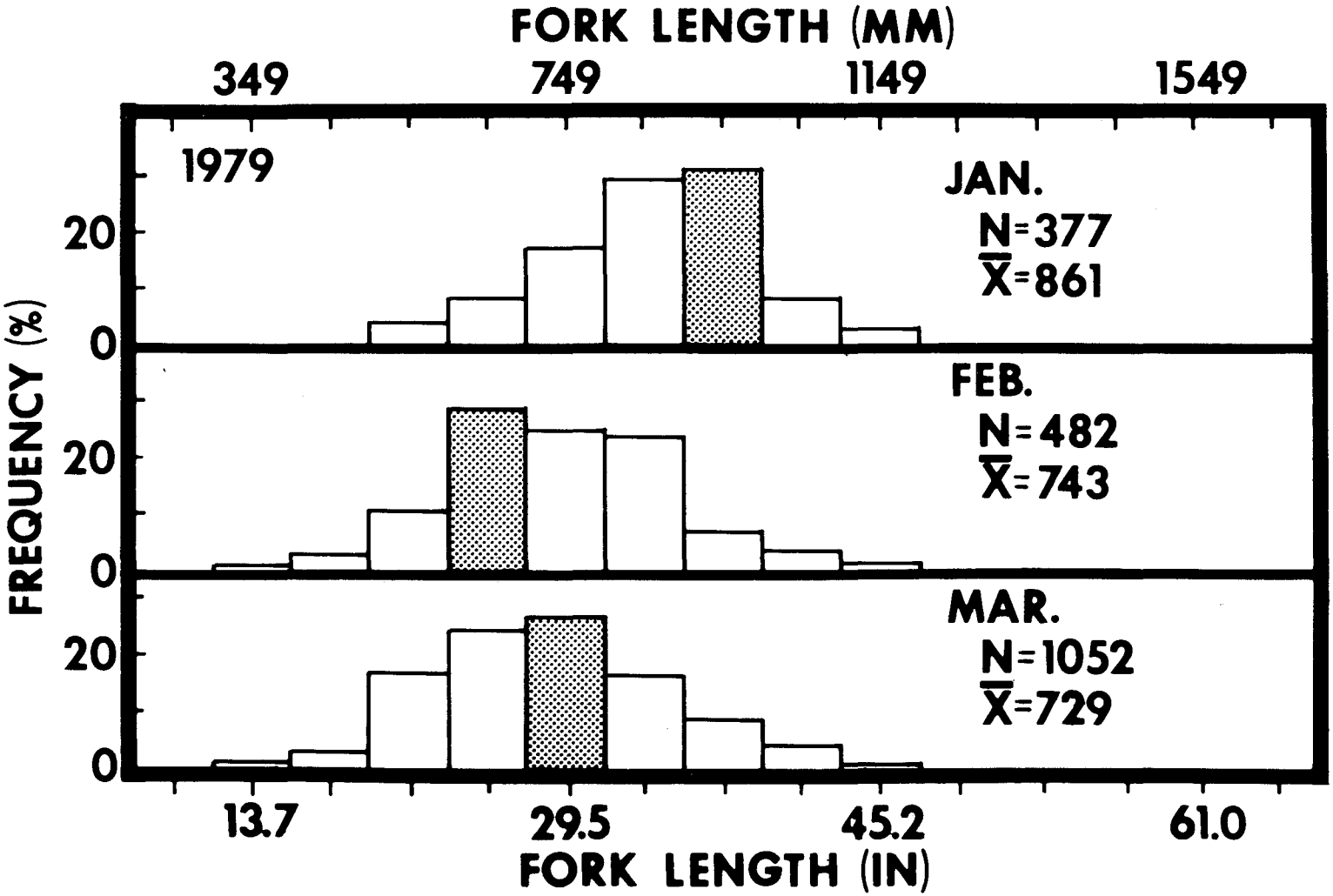

Figure 10. South Florida: Length-frequency distributions of king mackerel caught by recreational fishermen in 1979.

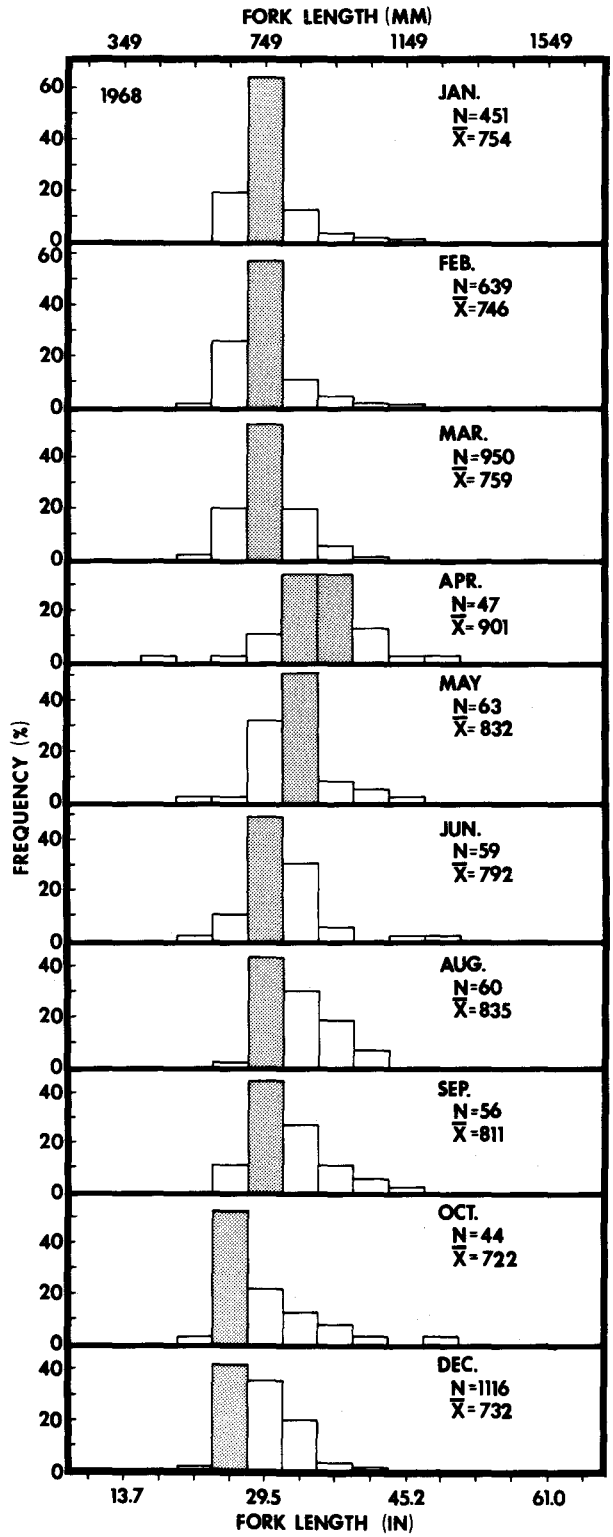

Figure 11. South Florida: Length-frequency distributions of king mackerel caught by commercial hook-and-line fishermen in 1968.

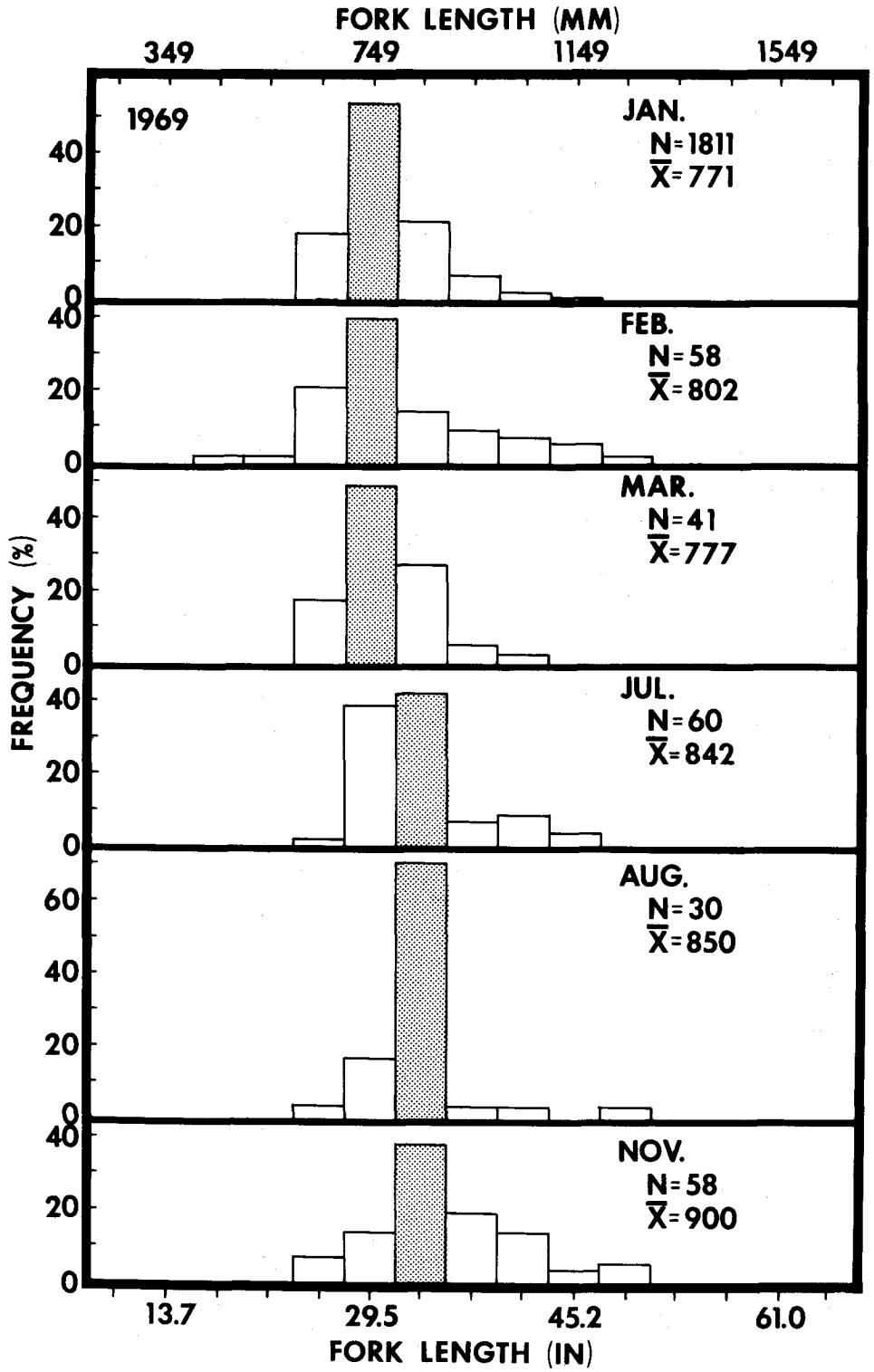

Figure 12. South Florida: Length-frequency distributions of king mackerel caught by commercial hook-and-line fishermen in 1969.

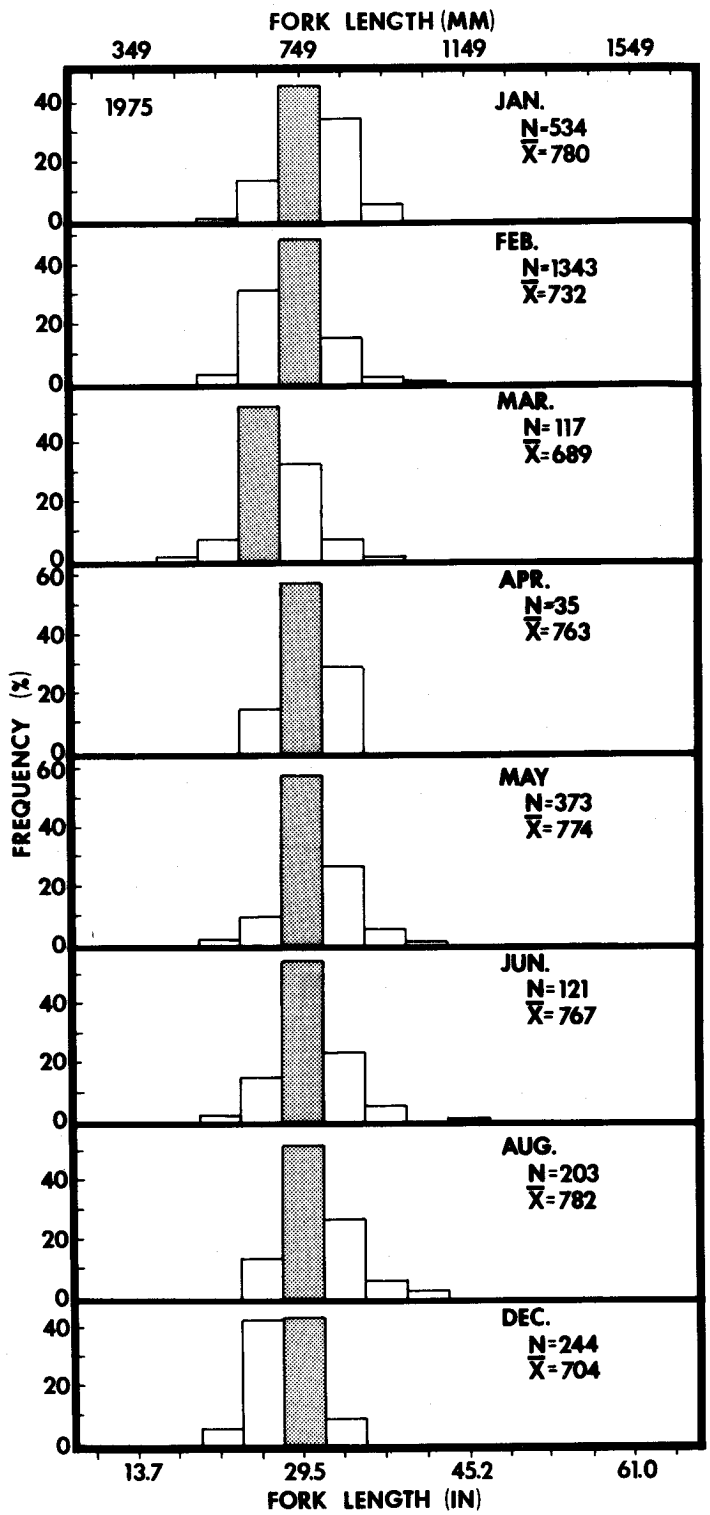

Figure 13. South Florida: Length-frequency distributions of king mackerel caught by commercial hook-and-line fishermen in 1975.

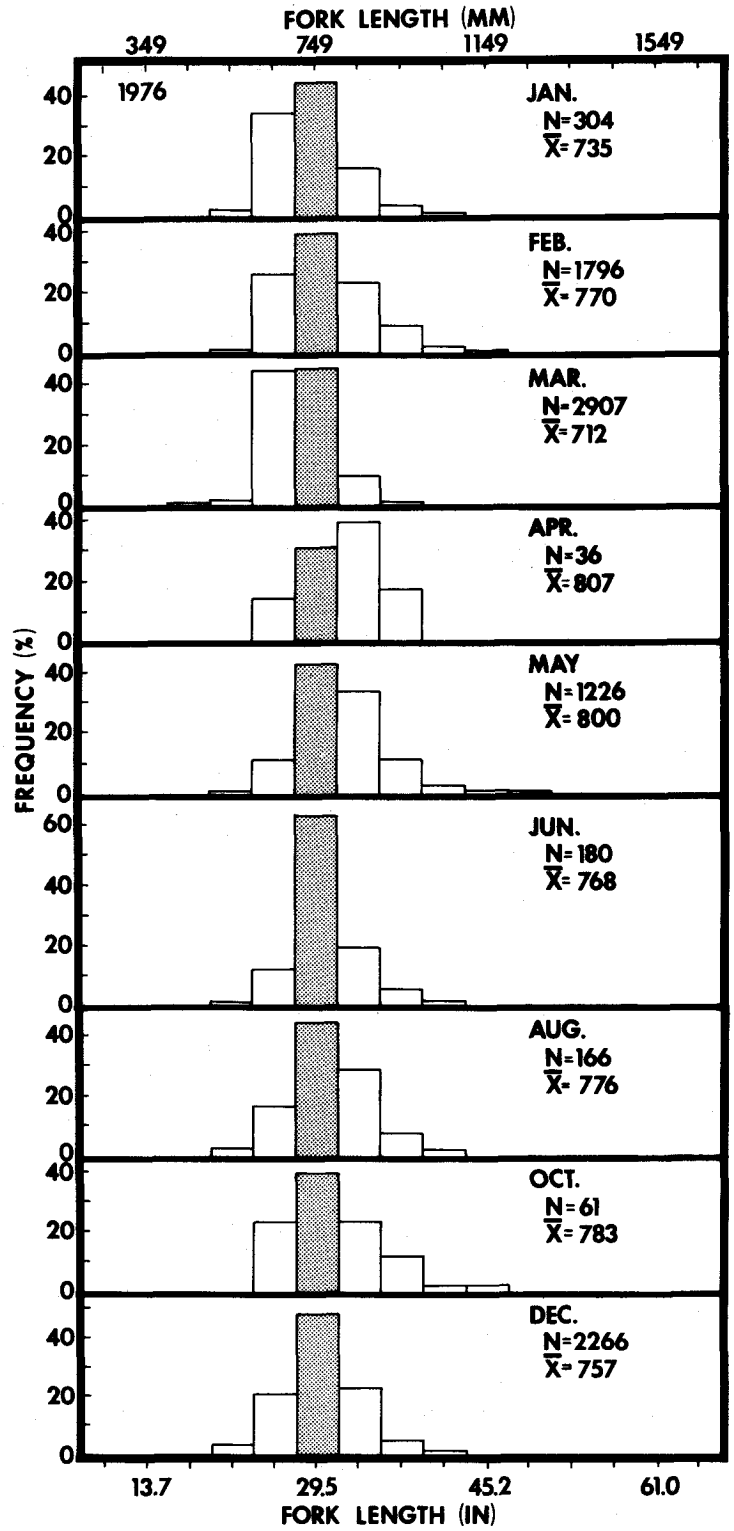

Figure 14. South Florida: Length-frequency distributions of king mackerel caught by commercial hook-and-line fishermen in 1976.

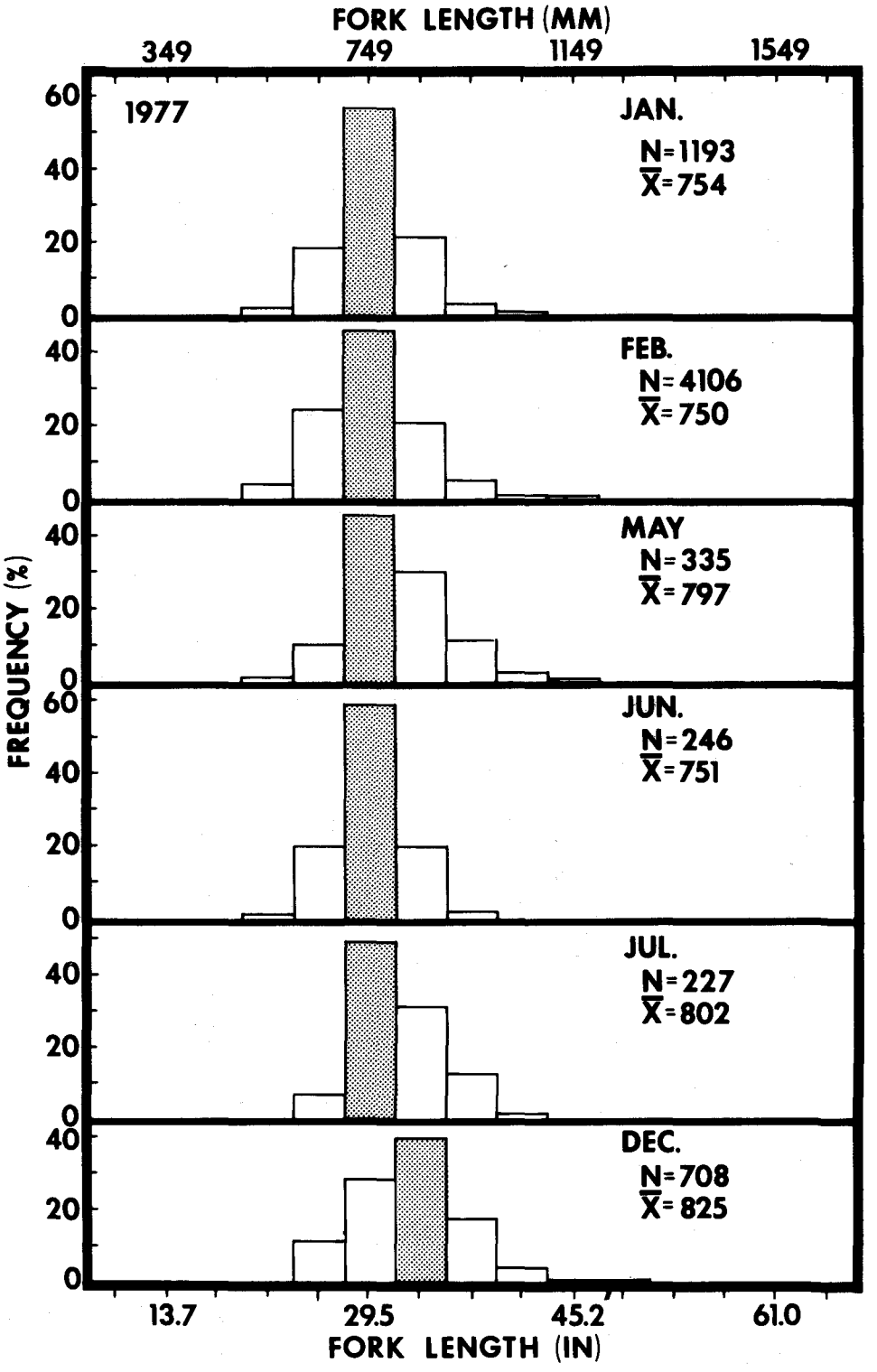

Figure 15. South Florida: Length-frequency distributions of king mackerel caught by commercial hook-and-line fishermen in 1977.

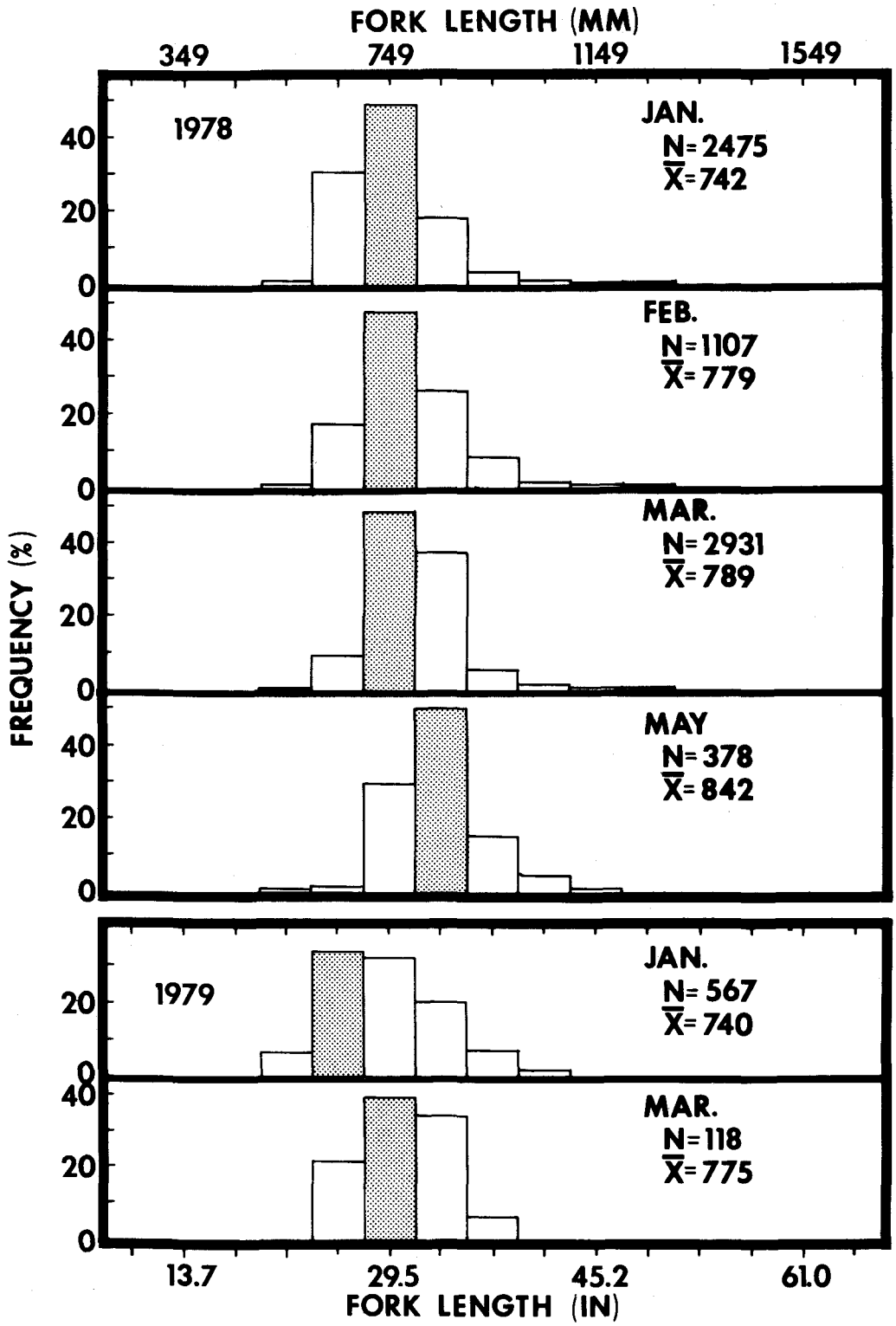

Figure 16. South Florida: Length-frequency distributions of king mackerel caught by commercial hook-and-line fishermen in 1978-79.

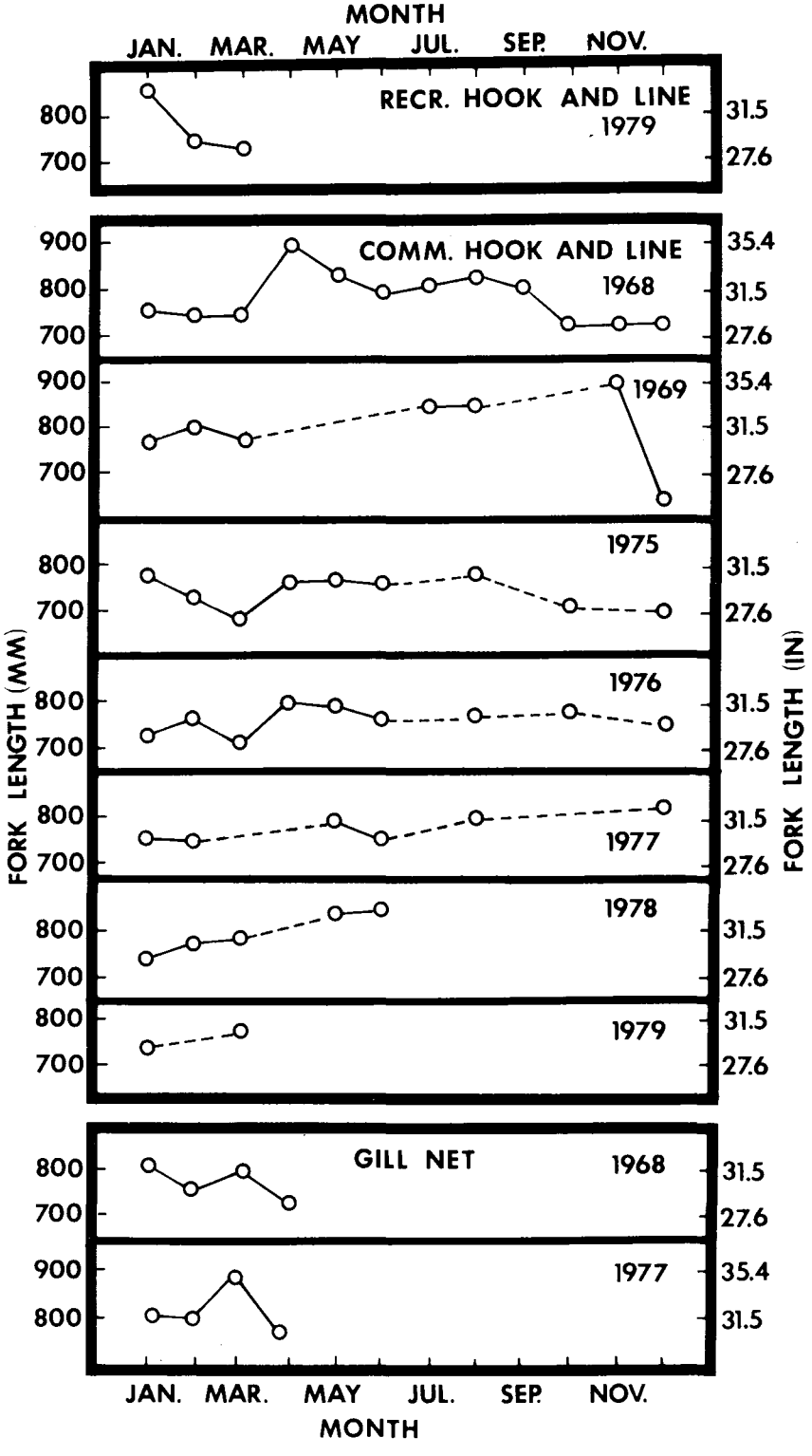

Figure 17. South Florida: Mean lengths (sexes combined) of king mackerel by type of gear and year..

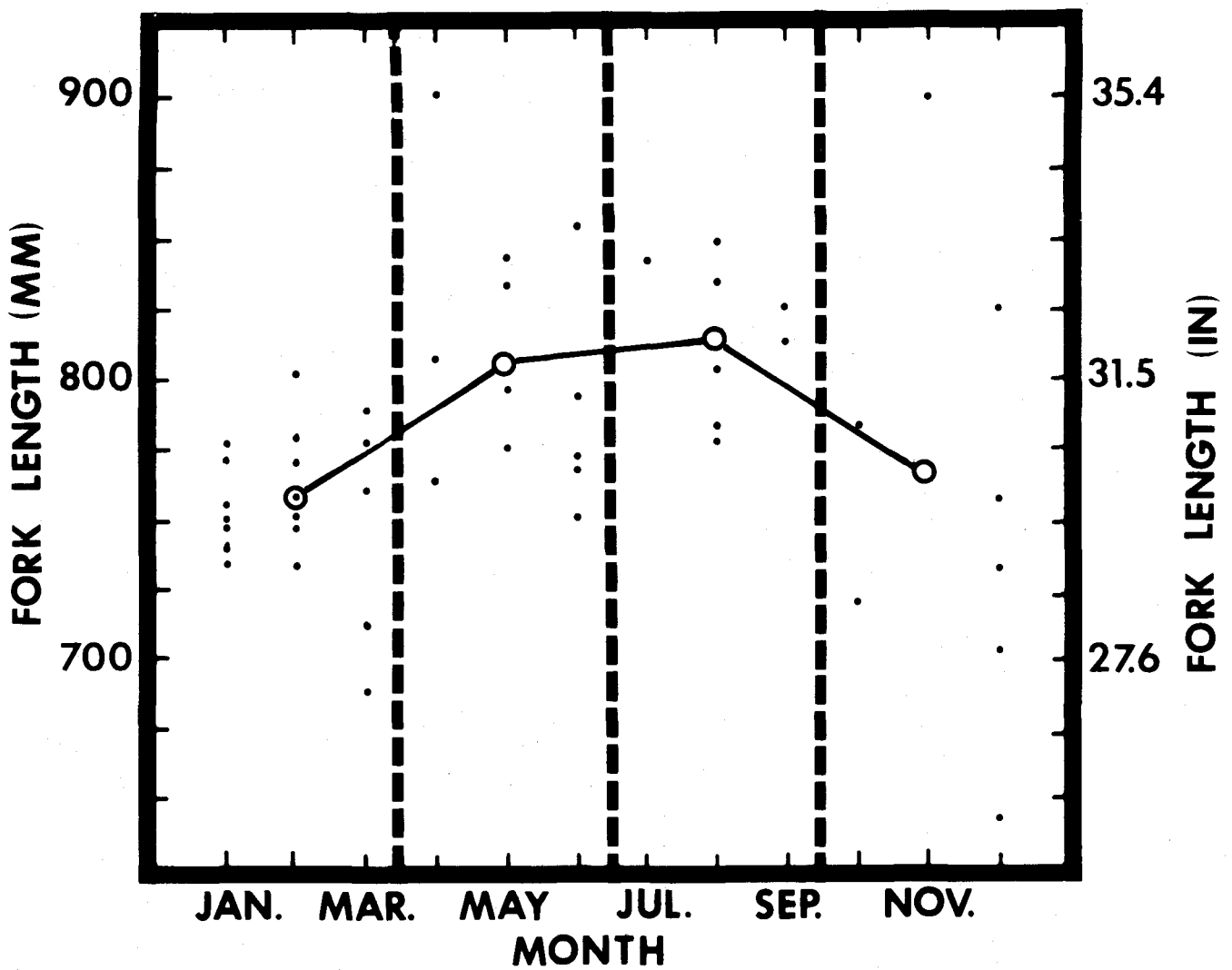

Figure 18. South Florida: Mean lengths (sexes combined) of king mackerel caught by commercial hook-and-line fishermen, 1968-69 and 1975-79

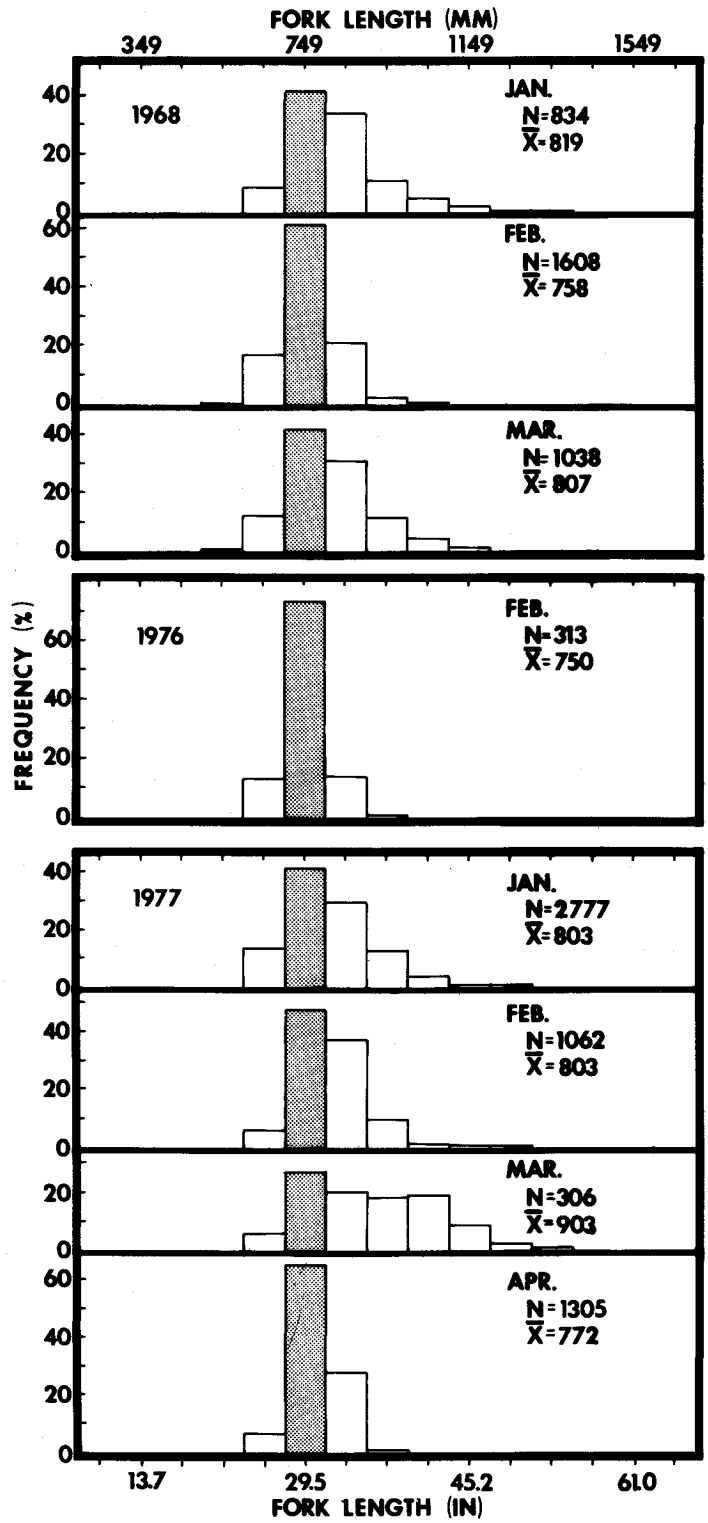

Figure 19. South Florida: Length-frequency distributions of king mackerel caught by commercial gill-net fishermen in 1968 and 1976-77.

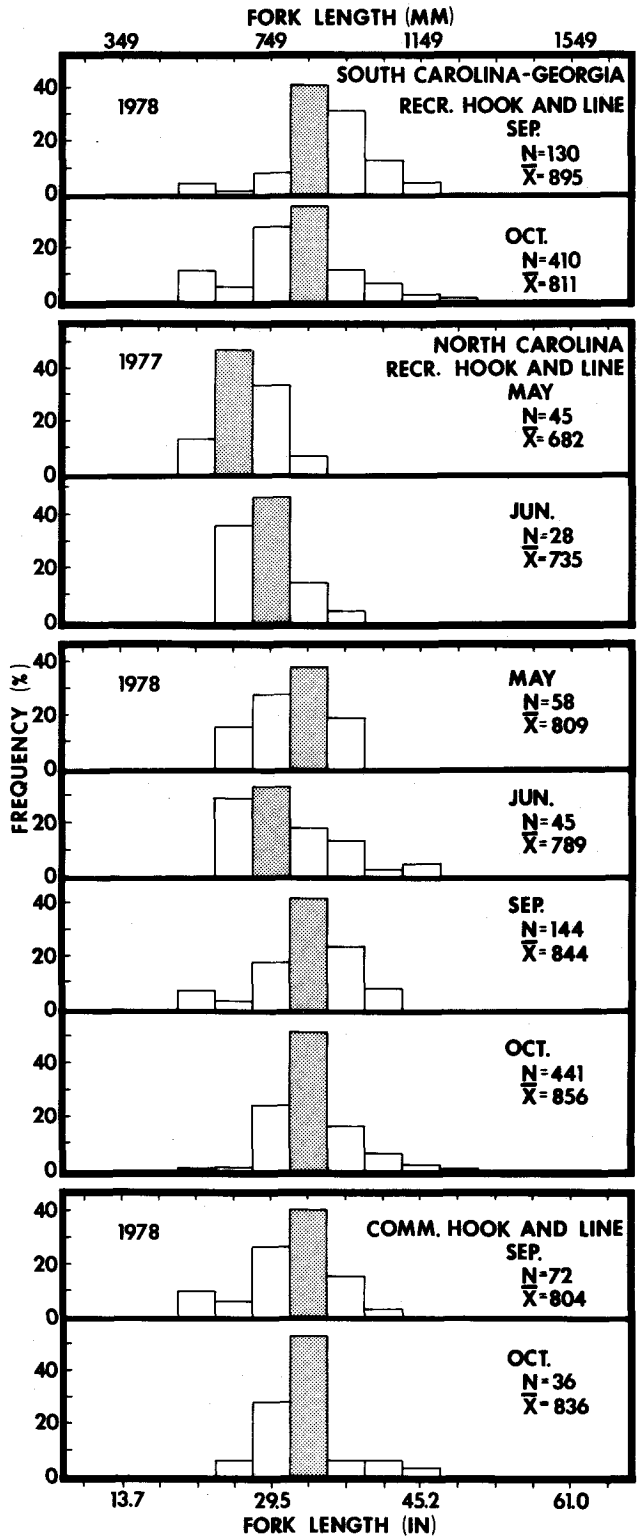

Figure 20. South Carolina, Georgia and North Carolina: Length-frequency distributions of king mackerel by type of gear in 1977-78.

Table 1. Data on king mackerel obtained by the Florida Department of Natural Resources (M = male, F = female, and U = sex unknown).

Year and Month	Recreational Hook and Line Northwest Florida M	Recreational Hook and Line Northwest Florida F	Commercial Hook and Line South Florida M	Commercial Hook and Line South Florida F	Commercial Hook and Line South Florida U	Commercial Hook and Line North Carolina U	Gill Net South Florida M	Gill Net South Florida F	Gill Net South Florida U
	Number of fish								
68 Jan			135	316			361	473	
Feb			182	457			792	816	
Mar			283	667			460	578	
Apr	22	36	28	19			5	13	
May	18	20	40	24					
Jun	17	55	26	33					
Jul	11	86							
Aug	14	46	22	38					
Sep	21	39	27	29					
Oct	17	22	19	23	2				
Nov				4			2	3	
Dec			445	671					
69 Jan			709	1,102					
Feb			15	43					
Mar			10	31			8	12	
Apr	4	16					10	12	
May	17	15							
Jun	6	8							
Jul	1	32	26	34					
Aug	5	24	11	19					
Sep	3	27							
Oct	1	8							
Nov	12	18	14	44					
Dec			6	9					
75 Jan					534				
Feb					1,343				
Mar					117				
Apr					35				
May					373				
Jun					121				
Aug					203				
Oct					3				
Dec					244				
76 Jan					304				
Feb					1,796				313
Mar					2,907				
Apr					36				
May					1,226				
Jun					180				
Aug					166				
Oct					61				
Dec					2,266				
77 Jan					1,193				2,777
Feb					4,106				1,062
Mar									306
May					335				
Jun					246				
Aug					227				
Dec					708				
78 Jan					2,475				
Feb					1,107				
Mar					2,931				
Apr					1,305				
May					378				
Jun					20				
Sep						72			
Oct						36			
79 May					809				
TOTAL	169	452	1,998	3,563	26,948	917	1,638	1,907	4,458

Table 2. Data on king mackerel obtained by the National Marine Fisheries Service (M = male, F = female, and U = sex unknown).

Year and Month	Recreational Hook and Line																			Commercial Hook and Line			Commercial Snapper Hook and Line		
	Texas			Louisiana			Mississippi		Northwest Florida			South Florida	South Carolina-Georgia			North Carolina			South Florida			Mississippi		
	M	F	U	M	F	U	M	F	M	F	U	U	M	F	U	M	F	U	M	F	U	M	F	U
	Number of fish																							
77 Feb				1	24																			
May																		45						
Jun	5	18	20	2	16	40			9	26	6							28						40
Jul	17	21	106			32			49	352	48					2	4	11						
Aug	9	9	251			19	1	7	4	255	59													
Sep				8	59				260	673														
Oct				10	135	6			180	94	23													
Dec				3	38																			
78 Jan				3	36																			
Feb					8																			
Mar				4	64																			
Apr					3																			
May	23	99		1	4				1	5						13	41	4						
Jun	95	281	13	7	61		2	12	5	23						2	19	24				20	29	19
Jul	193	254	75	13	86	1			177	456	7					2	13	4				4	11	15
Aug	234	262	1	5	81				301	259			3		7	3	16	2				15	28	31
Sep					24	1			417	472			2	1	127	5	48	91	205	138	1	4	1	2
Oct				4	75				203	255	16		156	248	6	103	256	82						
Nov					34												10	6						
Dec					7																			
79 Jan												371							209	346	12			
Feb												482												
Mar												1,052							33	85				
Jun																								
TOTAL	576	944	466	61	755	99	3	19	1,606	2,870	159	1,905	161	249	140	130	407	297	447	569	13	43	69	107

Table 3. Results of comparisons of length-frequency distributions of king mackerel between months by area, type of gear, and year using a chi-square test of homogeneity.

Area	Type of Fishermen	Year	Months Compared	Degrees Freedom	Chi-square Value
Texas	Recreational Hook and Line	1977	Jun-Jul	3	6.2
			Jul-Aug	5	31.3*
		1978	May-Jun	6	44.5*
			Jun-Jul	7	83.9*
			Jul-Aug	6	77.9*
Louisiana	Recreational Hook and Line	1977	Feb-Jun	5	23.9*
			Jun-Jul	4	4.8
			Jul-Sep	4	20.4*
			Sep-Oct	4	12.1*
			Oct-Dec	6	32.3*
		1977-78	Dec-Jan	4	2.6
		1978	Jan-Mar	5	29.1*
			Mar-Jun	5	44.7*
			Jun-Jul	4	2.2
			Jul-Aug	4	20.0*
			Aug-Sep	4	8.1
			Sep-Oct	4	3.9
			Oct-Nov	5	21.2*
Mississippi	Commercial Snapper	1978	Jun-Jul	5	10.3
			Jul-Aug	5	1.7
Northwest Florida	Recreational Hook and Line	1968	Apr-May	2	4.3
			May-Jun	2	4.4
			Jun-Jul	4	33.5*
			Jul-Aug	3	27.5*
			Aug-Sep	3	8.4
			Sep-Oct	2	5.0
		1969	Apr-May	2	11.3*
			May-Jun	2	1.0
			Jun-Jul	3	3.1
			Jul-Aug	3	33.1*
			Aug-Sep	2	13.0*
			Sep-Oct	2	14.0*
			Oct-Nov	2	8.1
		1977	Jun-Jul	6	36.0*
			Jul-Aug	6	62.8*
			Aug-Sep	5	53.4*
			Sep-Oct	5	32.0*
		1978	Jun-Jul	6	155.9*
			Jul-Aug	6	89.3*
			Aug-Sep	5	302.2*
			Sep-Oct	5	382.6*

Table 3. Continued

Area	Type of Fishermen	Year	Months Compared	Degrees Freedom	Chi-square Value
South Florida	Recreational Hook and Line	1979	Jan-Feb	7	158.0*
			Feb-Mar	7	26.7*
	Commercial Hook and Line	1968	Jan-Feb	5	12.3
			Feb-Mar	5	30.9*
			Mar-Apr	5	158.4*
			Apr-May	3	18.2*
			May-Jun	4	9.4
			Jun-Aug	3	9.7
			Aug-Sep	4	5.2
			Sep-Oct	4	22.6*
			Oct-Dec	5	24.1*
		1969	Jan-Feb	5	81.5*
			Feb-Mar	4	7.0
			Mar-Jul	4	10.9
			Jul-Aug	3	6.4
			Aug-Nov	5	11.2
		1975	Jan-Feb	5	142.6*
			Feb-Mar	4	34.1*
			Mar-Apr	2	25.0*
			Apr-May	3	2.3
			May-Jun	4	3.2
			Jun-Aug	4	2.2
			Aug-Dec	4	86.7*
		1976	Jan-Feb	6	32.2*
			Feb-Mar	6	546.3*
			Mar-Apr	4	196.0*
			Apr-May	4	3.7
			May-Jun	5	31.6*
			Jun-Aug	5	13.3
			Aug-Oct	4	2.5
			Oct-Dec	5	11.2
		1977	Jan-Feb	5	64.8*
			Feb-May	6	80.0*
			May-Jun	5	44.9*
			Jun-Jul	3	47.4*
			Jul-Dec	4	35.1*
		1978	Jan-Feb	7	141.5*
			Feb-Mar	6	100.8*
			Mar-May	5	152.5*
		1979	Jan-Mar	5	22.5*
	Gill Net	1968	Jan-Feb	5	292.2*
			Feb-Mar	5	257.6*

Table 3. Continued

Area	Type of Fishermen	Year	Months Compared	Degrees Freedom	Chi-square Value
		1977	Jan-Feb	5	97.4*
			Feb-Mar	6	322.9*
			Mar-Apr	4	643.5*
South Carolina-Georgia	Recreational Hook and Line	1978	Sep-Oct	6	55.8*
North Carolina	Recreational Hook and Line	1977	May-Jun	3	7.0
		1978	May-Jun	3	5.9
			Jun-Sep	5	40.4*
			Sep-Oct	5	37.6*
	Commercial Hook and Line	1978	Sep-Oct	5	10.0

*Probability $\leq$ .05.

Table 4. Number, mean fork length ($\bar{x}$ in millimeters), and sex ratio by month for king mackerel caught by recreational fishermen in Texas, 1977-78.

Year and Month	Male		Female		Sex Unknown		Total		Percent Female
	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	
1977									
Jun	5	809	18	810	20	782	43	812	78.3*
Jul	17	755	21	816	106	809	144	804	55.3
Aug	9	782	9	849	251	771	269	774	50.0
1978									
May	23	884	99	993	0	-	122	973	81.1*
Jun	95	835	281	907	13	864	389	888	74.7*
Jul	193	803	254	843	75	793	522	821	56.8*
Aug	234	837	262	921	1	949	497	881	52.8

*Significantly different (probability $\leq$ .05, chi-square test) from a 1:1 ratio.

Table 5. Sex composition of king mackerel by area, type of gear, year, and size class of fish. Ratios in parentheses were determined from samples of < 10 fish.

Fork Length Interval (mm)	Texas Recreational Hook & Line 1977	Texas Recreational Hook & Line 1978	Louisiana Recreational Hook & Line 1977	Louisiana Recreational Hook & Line 1978	Mississippi Commercial Snapper 1978	Northwest Florida Recreational Hook & Line 1968	Northwest Florida Recreational Hook & Line 1969	Northwest Florida Recreational Hook & Line 1977	Northwest Florida Recreational Hook & Line 1978	South Florida Commercial Hook & Line 1968	South Florida Commercial Hook & Line 1969	South Florida Commercial Hook & Line 1978	South Florida Commercial Hook & Line 1979	Gill Net 1968	S.C.-Ga. Recr. H. & L. 1978	N.C. Recr. H. & L. 1978
	Area, Type of Gear, and Year															
	Percent Female															
300- 499						(75.0)	(100.0)	(100.0)	33.3*	(100.0)	(100)		(100.0)			
500- 699	(57.1)	41.8	(100.0)		(0.0)	68.0*	70.7*	73.3*	57.0*	52.7	35.6*	(37.5)	58.2*	24.3*	57.8	61.9
700- 899	56.9	52.3	85.4*	80.0*	58.5	73.5*	72.2*	72.0*	72.7*	69.4*	65.0*	34.9*	63.4*	56.3*	54.6	68.2*
900-1099	(100.0)	78.3*	90.2*	86.5*	61.0	85.0*	100.0*	88.6*	96.5*	78.5*	84.4*	67.9*	94.3*	70.7*	82.4*	94.0*
1100-1299		94.7*	98.1*	97.9*	100.0*	(100.0)	100.0*	(87.5)	100.0*	100.0*	93.3*	(100.0)	(100.0)	100.0*	100.0*	100.0*
1300-1499		(100.0)	100.0*	98.9*		(100.0)								(100.0)	(100.0)	
1500-1699			(100.0)	(100.0)												
300-1699	60.8*	62.2*	91.9*	92.9*	63.5*	71.7*	75.1*	73.6*	57.1*	65.4*	61.8*	40.2*	64.0*	53.7*	61.5*	75.8*

*Significantly different (probability $\leq$ .05, chi-square test) from a 1:1 ratio.

Table 6. Number, mean fork length ($\bar{x}$ in millimeters), and sex ratio by month for king mackerel caught off Louisiana and Mississippi, 1977-78.

Area, Year, and Month	Type of Fisherman	Male No.	Male $\bar{x}$	Female No.	Female $\bar{x}$	Sex Unknown No.	Sex Unknown $\bar{x}$	Total No.	Total $\bar{x}$	Percent Female
Louisiana										
1977	Recreational									
Feb	Hook & Line	1	1,049	24	1,241	0	-----	25	1,233	96.0*
Jun		2	999	16	1,018	40	1,064	58	1,032	88.9*
Jul		-	-----	--	-----	32	1,077	32	1,077	----
Aug		-	-----	--	-----	19	1,133	19	1,133	----
Sep		8	974	59	956	0	-----	67	958	88.1*
Oct		10	899	135	1,025	6	999	151	1,016	93.1*
Dec		3	982	38	1,165	0	-----	41	1,152	92.7*
1978										
Jan		3	916	36	1,160	0	-----	39	1,141	92.3*
Feb		0	-----	8	1,287	0	-----	8	1,287	100.0*
Mar		4	1,249	64	1,302	0	-----	68	1,299	94.1*
Apr		0	-----	3	1,316	0	-----	3	1,316	100.0*
May		1	1,149	4	1,124	0	-----	5	1,132	80.0*
Jun		7	1,006	61	1,140	0	-----	68	1,126	89.7*
Jul		13	995	86	1,119	1	1,249	100	1,104	86.9*
Aug		5	909	81	1,169	0	-----	86	1,154	94.2*
Sep		0	-----	24	1,107	1	949	25	1,101	100.0*
Oct		4	949	75	1,052	0	-----	79	1,047	94.9*
Nov		0	-----	34	1,196	0	-----	34	1,196	100.0*
Dec		0	-----	7	1,249	0	-----	7	1,249	100.0*
Mississippi										
	Recreational Hook & Line									
1977										
Aug		1	1,049	7	1,092	0	-----	8	1,087	87.5*
1978										
Jun		2	449	12	1,032	0	-----	14	949	85.7*
1977	Commercial Snapper									
Jun	Hook & Line	-	-----	--	-----	40	1,064	40	1,064	-----
1978										
Jun		20	854	29	911	19	928	68	899	59.2
Jul		4	924	11	922	15	1,002	30	962	73.3*
Aug		15	882	28	981	31	943	74	945	65.1*
Sep		4	899	1	1,249	2	799	7	920	20.0

*Significantly different (probability $\leq$ .05, chi-square test) from a 1:1 ratio.

Table 7. Number, mean fork length ($\bar{x}$ in millimeters), and sex ratio by month for king mackerel caught by recreational fishermen from northwest Florida, 1968-69 and 1977-78.

Year and Month	Male		Female		Sex Unknown		Total		Percent Female
	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	
1968									
Apr	22	717	36	780	0	-	58	757	62.1
May	18	677	20	774	0	-	38	729	52.6
Jun	17	743	55	744	0	-	72	743	76.4*
Jul	11	558	86	672	0	-	97	660	88.7*
Aug	14	728	46	710	0	-	60	715	76.7*
Sep	21	673	39	705	0	-	60	695	65.0*
Oct	17	731	22	722	0	-	39	724	56.4
1969									
Apr	4	724	16	1,005	0	-	20	950	80.0*
May	17	737	15	756	0	-	32	747	46.9
Jun	6	682	8	824	0	-	14	764	57.1
Jul	1	649	32	802	0	-	33	798	97.0*
Aug	5	589	24	595	0	-	29	595	82.8*
Sep	3	582	27	716	0	-	30	703	90.0*
Oct	1	849	8	912	0	-	9	906	88.9*
Nov	12	774	18	799	0	-	30	790	60.0
1977									
Jun	9	805	26	857	6	849	41	844	74.3*
Jul	49	790	352	747	48	764	449	753	87.8*
Aug	4	649	255	694	59	705	317	697	98.4*
Sep	260	694	673	729	0	-	933	720	72.1*
Oct	180	710	94	722	23	692	297	713	34.3*
1978									
May	1	649	5	809	0	-	6	782	83.3*
Jun	5	689	23	862	0	-	28	831	82.1*
Jul	177	556	456	625	7	620	640	606	72.0*
Aug	301	530	259	612	0	-	560	568	42.2*
Sep	417	556	472	583	0	-	889	570	53.1
Oct	203	634	255	624	16	630	474	628	55.7*

*Significantly different (probability $\leq$ .05, chi-square test) from a 1:1 ratio.

Table 8. Number, mean fork length ($\bar{x}$ in millimeters), and sex ratio by month for king mackerel caught by commercial hook-and-line and gill-net fishermen off south Florida, 1968-69 and 1978-79.

Year and Month	Type of Fishermen	Male		Female		Sex Unknown		Total		Percent Female
		No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	
1968										
Jan	Commercial	135	728	316	764	0	-	451	754	70.1*
Feb	Hook and Line	182	723	457	754	0	-	639	746	71.5*
Mar		283	746	667	764	0	-	950	759	87.9*
Apr		28	878	19	933	0	-	47	901	40.4
May		40	824	24	878	0	-	63	832	38.1*
Jun		26	791	33	791	0	-	59	792	55.9
Aug		22	799	38	854	0	-	60	835	63.3*
Sep		27	768	29	849	0	-	56	811	51.8
Oct		19	712	23	758	2	399	44	722	54.8
Nov		0	-	4	1,074	0	-	4	1,075	100.0
Dec		445	707	671	748	0	-	1,116	732	60.1
1969										
Jan		709	741	1,102	789	0	-	1,811	771	60.8*
Feb		15	742	43	821	0	-	58	802	74.1*
Mar		10	719	31	797	0	-	41	777	75.6*
Jul		26	799	34	873	0	-	60	842	56.7
Aug		11	840	19	854	0	-	30	850	63.3
Nov		14	799	44	931	0	-	58	900	75.9*
Dec		6	649	9	638	0	-	15	643	60.0
1978										
Sep		205	805	138	858	1	749	344	826	40.2*
1979										
Jan		209	715	346	757	12	716	567	740	62.3*
Mar		33	740	85	788	0	-	118	775	72.0*
1968										
Jan	Gill Net	361	790	473	839	0	-	834	819	56.7*
Feb		792	743	816	770	0	-	1,608	758	50.7
Mar		460	776	578	830	0	-	1,038	807	55.7*
Apr		5	709	13	734	0	-	18	728	72.2*
Nov		2	799	3	882	0	-	5	849	60.0
1969										
Mar		8	837	12	857	0	-	20	849	60.0*
Apr		10	749	12	857	0	-	22	807	54.5

*Significantly different (probability $\leq .05$, chi-square test) from a 1:1 ratio.

Table 9. Numbers and mean fork lengths ($\bar{x}$ in millimeters) of king mackerel of undetermined sex caught by recreational and commercial fishermen off south Florida 1975-79

	Recreational Hook and Line		Commercial Hook and Line								Gill Net					
	1979		1975		1976		1977		1978		1976		1977		1978	
Month	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$
Jan	371	861	534	780	304	735	1,193	754	2,475	742			2,777	803		
Feb	482	743	1,343	732	1,796	770	4,106	750	1,107	779	313	750	1,062	803		
Mar	1,052	729	117	689	2,907	712			2,931	789			306	903		
Apr			35	763	36	807							1,305	772	1,305	772
May			373	774	1,226	800	335	797	378	842						
Jun			121	767	180	768	246	751	20	854						
Aug			203	782	166	776	227	802								
Oct			3	716	61	783										
Dec			244	704	2,266	757	708	825								

Table 10. Number, mean fork length ($\bar{x}$ in millimeters), and sex ratio by month for king mackerel by type of gear off South Carolina-Georgia and North Carolina, 1977-79.

Area	Type of Fishermen	Year and Month	Male		Female		Sex Unknown		Total		Percent Female
			No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	No.	$\bar{x}$	
South Carolina-Georgia	Recreational Hook and Line	1978									
		Aug	0	---	3	849	7	920	10	899	100.0*
		Sep	2	649	1	949	127	899	130	895	33.3
		Oct	156	775	248	839	6	616	410	811	61.4*
North Carolina		1977									
		May	---	---	---	---	45	682	45	682	---
		Jun	---	---	---	---	28	735	28	735	---
		Jul	2	799	4	724	11	804	17	784	66.3
		1978									
		May	13	726	41	842	4	749	58	809	75.9*
		Jun	2	699	19	781	24	803	45	789	90.5*
		Jul	2	849	13	841	4	874	19	849	86.7*
		Aug	3	749	16	912	2	949	21	892	84.2*
		Sep	5	829	48	907	91	812	144	844	90.6*
		Oct	103	824	256	876	82	836	441	856	71.3*
		Nov	0	---	10	1,069	6	799	16	968	100.0*
	Commercial Hook and Line	1978									
		Sep	---	---	---	---	72	804	72	804	---
		Oct	---	---	---	---	36	836	36	836	---
		1979									
		May	---	---	---	---	809	867	809	867	---

*Significantly different (probability $\leq .05$, chi-square test) from a 1:1 ratio.

Appendix Table 1. Length-frequency distributions of king mackerel caught off Texas, 1977-78 (M = male, F = female, U = sex unknown).

Midpoint of fork length interval (mm)	Recreational Hook and Line										
	1977									1978	
	Jun			Jul			Aug			May	
	M	F	U	M	F	U	M	F	U	M	F
	Number of fish										
549									13		
649		1	1	3	2	4		1	34		3
749	2	6	6	10	7	48	6	2	132	5	4
849	3	10	12	4	9	41	3	3	43	8	22
949		1	1		2	12		2	15	7	28
1049					1	1		1	14	3	18
1149											13
1249											6
1349											4
1449											1
Total	5	18	20	17	21	106	9	9	251	23	99
Mean Length	809	810	782	755	816	809	782	849	771	884	993

	Recreational Hook and Line								
	1978								
	Jun			Jul			Aug		
	M	F	U	M	F	U	M	F	U
	Number of fish								
449					1				
549	1			2	1		2	1	
649	3	3	1	20	17	12	11	3	
749	31	35	3	70	66	30	65	28	
849	39	109	4	76	100	25	106	75	
949	16	88	4	21	50	4	37	100	1
1049	4	26		4	16	4	11	43	
1149	1	15	1		3		2	9	
1249		5						3	
Total	95	281	13	193	254	75	234	262	1
Mean Length	835	907	864	803	843	793	837	921	949

Appendix Table 2. Length-frequency distributions of king mackerel caught off Louisiana, 1977-78. (M = male, F = female, U = sex unknown).

Midpoint of fork length interval (mm)	Recreational Hook and Line						
	1977						
	Feb		Jun			Jul	Aug
	M	F	M	F	U	U	U
	Number of fish						
649				1			1
749				1	2		
849				2	2	1	
949			1	3	7	9	4
1049	1	2	1	4	13	12	6
1149		9		3	10	4	
1249		6		1	5	3	
1349		4			1	2	8
1449		2		1		1	
1549		1					
Total	1	24	2	16	40	32	19
Mean Length	1049	1241	999	1018	1064	1077	1133

Midpoint of fork length interval (mm)	Recreational Hook and Line						
	1977						
	Sep		Oct			Dec	
	M	F	M	F	U	M	F
	Number of fish						
749		1	1	1			
849	2	15	3	14			1
949	3	27	6	47	3	2	7
1049	2	12		47	3	1	8
1149	1	3		16			6
1249		1		3			5
1349				5			7
1449				1			4
1549				1			
Total	8	59	10	135	6	3	38
Mean Length	974	956	899	1025	999	982	1165

Appendix Table 2. Continued

Midpoint of fork length interval (mm)	Recreational Hook and Line 1978 Jan M	Jan F	Feb F	Mar M	Mar F	Apr F
	Number of fish					
849	1				1	
949	2	5			2	
1049		7	1		2	
1149		10	1	1	7	
1249		7	2	2	20	1
1349		7	2	1	12	2
1449			2		17	
1549					3	
Total	3	36	8	4	64	3
Mean Length	916	1160	1287	1249	1302	1316

	Recreational Hook and Line 1978 May M	May F	Jun M	Jun F	Jul M	Jul F	Jul U
	Number of fish						
849						2	
949		2	3	8	7	7	
1049			4	17	6	29	
1149	1			17		29	
1249		1		12		14	1
1349		1		5		5	
1449				2			
Total	1	4	7	61	13	86	1
Mean Length	1149	1124	1006	1140	995	1119	1249

Appendix Table 2. Continued

Midpoint of fork length interval (mm)	Recreational Hook and Line 1978							
	Aug		Sep		Oct		Nov	Dec
	M	F	F	U	M	F	F	F
	Number of fish							
849	2	2				6	1	
949	3	12	5	1	4	20	3	
1049		16	11			31	8	
1149		16	2			8	6	4
1249		14	3			6	7	
1349		15	1			2	3	2
1449		6	2			2	4	1
1549							2	
Total	5	81	24	1	4	75	34	7
Mean Length	909	1169	1107	949	949	1052	1196	1249

Appendix Table 3. Length-frequency distributions of king mackerel caught off Mississippi, 1977-78 (M = male, F = female, U = sex unknown).

Midpoint of fork length interval (mm)	Recreational Hook and Line				Commercial Snapper Hook and Line			
	1977		1978		1977	1978		
	Aug		Jun		Jun	Jun		
	M	F	M	F	U	M	F	U
	Number of fish							
449			2	2				
549								
649						1		1
749					2	5	11	3
849					2	7	6	6
949		3		2	7	6	3	3
1049	1	2		1	13	1	3	1
1149				4	10		4	5
1249				1	5		2	
1349		2		2	1			
Total	1	7	2	12	40	20	29	19
Mean Length	1049	1092	449	1032	1064	854	911	928

	Commercial Snapper Hook and Line								
	1978								
	Jul			Aug			Sep		
	M	F	U	M	F	U	M	F	U
	Number of fish								
749		1		1	1	5	1		1
849	1	4	5	8	8	8			1
949	3	4	3	6	7	8	3		
1049		1	3		7	5			
1149		1	3		3	4			
1249					2	1		1	
1349			1						
Total	4	11	15	15	28	31	4	1	2
Mean Length	924	922	1002	882	981	943	899	1249	799

Appendix Table 4. Length-frequency distributions of king mackerel caught off northwest Florida, 1968-69 and 1977-79 (M = male, F = female, U = sex unknown).

Midpoint of fork length interval (mm)	Recreational Hook and Line 1968 Apr M	Apr F	May M	May F	Jun M	Jun F	Jul M	Jul F
	Number of fish							
449							1	3
549	1					4	9	23
649	8	6	13	4	6	10		29
749	11	22	5	13	7	31	1	17
849	1	3		1	3	6		10
949	1	2		1	1	3		4
1049		2				1		
1149		1						
1249								
1349				1				
Total	22	36	18	20	17	55	11	86
Mean Length	717	780	677	774	743	744	558	672

	Recreational Hook and Line 1968 Aug M	Aug F	Sep M	Sep F	Oct M	Oct F	1969 Apr M	Apr F
	Number of fish							
549	1	2	1	2				
649	1	21	14	22	8	9	1	
749	12	17	6	8	6	11	3	4
849		5		5	2	1		
949		1		2		1		3
1049					1			3
1149								4
1249								2
Total	14	46	21	39	17	22	4	16
Mean Length	728	710	673	705	731	722	724	1005

Appendix Table 4. Continued

Midpoint of fork length interval (mm)	Recreational Hook and Line 1969 May M	May F	Jun M	Jun F	Jul M	Jul F	Aug M	Aug F
	Number of fish							
449						1		1
549						1	3	14
649	3	3	4		1	4	2	6
749	13	8	2	5		10		3
849	1	4		2		13		
949								
1049								
1149				1		2		
1249						1		
Total	17	15	6	8	1	32	5	24
Mean Length	737	756	682	824	649	802	589	595

	Recreational Hook and Line 1969 Sep M	Sep F	Oct M	Oct F	Nov M	Nov F	1977 Jun M	Jun F	Jun U
	Number of fish								
549	2	6							
649	1	5				2			
749		9		1	9	7	5	8	
849		6	1	4	3	7	3	9	6
949		1		1		2	1	8	
1049				1				1	
1149				1					
Total	3	27	1	8	12	18	9	26	6
Mean Length	582	716	849	912	774	799	805	857	849

Appendix Table 4. Continued

Midpoint of fork length interval (mm)	Recreational Hook and Line 1977 Jul M	Jul F	Jul U	Aug M	Aug F	Aug U	Sep M	Sep F
	Number of fish							
349					1			
449								2
549	3	31	5		27	5	22	34
649	11	107	14	4	142	31	113	249
749	11	109	14		44	15	112	247
849	14	69	7		28	5	11	100
949	8	21	3		8	1	2	33
1049	1	11	3		3	1		7
1149	1	3	1		2			1
1249		1	1			1		
Total	49	352	48	4	255	59	260	673
Mean Length	790	747	764	649	694	705	694	729

	Recreational Hook and Line 1977 Oct M	Oct F	Oct U	1978 May M	May F	Jun M	Jun F
	Number of fish						
549	6	1	1			1	
649	69	34	11	1	1	2	1
749	94	49	11		1	1	6
849	11	9			2	1	8
949		1			1		6
1049							1
1149							1
Total	180	94	23	1	5	5	23
Mean Length	710	722	692	649	809	689	862

Appendix Table 4. Continued

Midpoint of fork length interval (mm)	Recreational Hook and Line 1978 Jul M	Jul F	Jul U	Aug M	Aug F	Sep M	Sep F
	Number of fish						
349		2	1				
449	22	7	1	101	22	3	
549	126	223	2	164	90	380	356
649	26	171	1	30	130	34	85
749	1	10		4	6		22
849	1	21	1	2	7		8
949	1	12	1				
1049		5			2		
1149		3			1		1
1249		2			1		1
Total	177	456	7	301	259	417	472
Mean Length	556	625	620	530	612	556	583

	Recreational Hook and Line 1978 Oct M	Oct F	Oct U	1979 Apr U	May U	Jun U	Jul U	Aug U	Sep U	Oct U
	Number of fish									
349			1							
449	12	36	6				1	4	2	
549	68	100				32	43	178	50	6
649	70	39	2		15	138	85	202	94	9
749	45	57	4	2	35	64	33	20	17	8
849	8	20	1	8	12	6	8	3	1	9
949		1	2	1	5	6	7	2		2
1049		1		5			2	3	1	
1149		1				1	1		2	
1249					1					
Total	203	255	16	16	68	247	180	412	167	34
Mean Length	634	624	630	908	772	679	675	619	639	725

Appendix Table 5. Length-frequency distributions of king mackerel caught off south Florida, 1968-69 and 1975-79 (M = male, F = female, U = sex unknown).

Midpoint of fork length interval (mm)	Recreational Hook and Line 1979 Jan U	Feb U	Mar U	Commercial Hook and Line 1968 Jan M	Jan F	Feb M	Feb F
	Number of fish						
349		2	4				
449		12	30				
549	14	48	175	1		2	6
649	30	136	254	40	45	75	89
749	63	118	281	82	208	81	283
849	108	113	171	11	43	17	50
949	115	32	90	1	12	7	17
1049	30	16	43		6		7
1149	10	5	4		2		4
1249	1						1
Total	371	482	1052	135	316	182	457
Mean Length	861	743	729	728	764	723	754

	Commercial Hook and Line 1968 Mar M	Mar F	Apr M	Apr F	May M	May F	Jun M	Jun F
	Number of fish							
449				1				
549	4	10			1		1	
649	83	108		1	1		2	4
749	126	377	3	2	10	10	10	19
849	58	127	15	1	25	7	11	7
949	12	37	9	7	1	4	2	1
1049		7	1	5	2	1		
1149				1		1		1
1249		1		1				1
1349								
1449								
1549								
1649						1		
Total	283	667	28	19	40	24	26	33
Mean Length	746	764	878	933	824	878	791	791

Appendix Table 5. Continued

Midpoint of fork length interval (mm)	Commercial Hook and Line 1968 Aug M	Aug F	Sep M	Sep F	Oct M	Oct F	Oct U
	Number of fish						
349							1
449							1
549						1	
649	1		5	1	12	10	
749	11	15	14	11	4	5	
849	8	10	7	8	1	4	
949	2	9		6	2	1	
1049		4	1	2		1	
1149				1			
1249						1	
Total	22	38	27	29	19	23	2
Mean Length	799	854	768	849	712	758	399

	Commercial Hook and Line 1968 Nov F	Dec M	Dec F	1969 Jan M	Jan F	Feb M	Feb F
	Number of fish						
449							1
549		5	4	1			
649	1	229	235	213	109	5	7
749		164	229	369	594	7	16
849		44	174	101	278	2	6
949		2	26	21	92	1	4
1049	1	1	3	3	27		4
1149				1	2		3
1249	2						1
Total	4	445	671	709	1102	15	43
Mean Length	1049	707	748	741	789	742	821

Appendix Table 5. Continued

Midpoint of fork length interval (mm)	Commercial Hook and Line 1969 Mar M	Mar F	Jul M	Jul F	Aug M	Aug F	Nov M	Nov F
	Number of fish							
649	5	2	1			1	3	1
749	4	16	13	10	1	4	3	5
849		10	10	15	10	11	7	15
949	1	2	2	2		1		11
1049		1		5		1	1	7
1149				2				2
1249						1		3
Total	10	31	26	34	11	19	14	44
Mean Length	719	797	799	873	840	854	799	931

	Commercial Hook and Line 1969 Dec M	Dec F	1975 Jan U	Feb U	Mar U	Apr U
	Number of fish					
449				1	1	
549	1	3	2	37	8	
649	4	5	73	420	61	5
749	1		245	652	38	20
849		1	184	201	8	10
949			29	27	1	
1049			1	5		
Total	6	9	534	1343	117	35
Mean Length	649	638	780	732	689	763

Appendix Table 5. Continued

Midpoint of fork length interval (mm)	Commercial Hook and Line 1975 May U	Jun U	Aug U	Oct U	Dec U	1976 Jan U	Feb U
	Number of fish						
549	5	2			13	6	15
649	35	18	27	1	104	104	465
749	214	66	105	2	106	135	704
849	99	28	54		21	47	409
949	19	6	12			10	157
1049	1		5			2	34
1149		1					9
1249							2
1349							1
Total	373	121	203	3	244	304	1796
Mean Length	774	767	782	716	704	735	770

	Commercial Hook and Line 1976 Mar U	Apr U	May U	Jun U	Aug U	Oct U	Dec U
	Number of fish						
449	10						
549	33		4	1	4		75
649	1284	5	132	21	27	14	467
749	1301	11	520	113	73	24	1085
849	267	14	407	34	47	14	509
949	12	6	133	9	12	7	104
1049			26	2	3	1	25
1149			3			1	1
1249			1				
Total	2907	36	1226	180	166	61	2266
Mean Length	712	807	800	768	776	783	757

Appendix Table 5. Continued

Midpoint of fork length interval (mm)	Commercial Hook and Line 1977					
	Jan	Feb	May	Jun	Aug	Dec
	U	U	U	U	U	U
	Number of fish					
549	23	164	4	2		
649	214	990	33	48	15	76
749	670	1873	152	144	111	200
849	252	841	100	48	70	281
949	32	202	37	4	28	122
1049	2	27	8		3	27
1149		9	1			1
1249						1
Total	1193	4106	335	246	227	708
Mean Length	754	750	797	751	802	825

	Commercial Hook and Line 1978							
	Jan	Feb	Mar	May	Jun	Sep		
	U	U	U	U	U	M	F	U
	Number of fish							
549	14	4	2	1		1		
649	746	186	256	4		4	3	
749	1201	525	1418	111	5	98	27	1
849	435	287	1083	188	11	85	71	
949	69	86	143	56	2	15	30	
1049	5	13	26	16	2	2	6	
1149	3	5	2	2			1	
1249	2	1	1					
Total	2475	1107	2931	378	20	205	138	1
Mean Length	742	779	789	842	854	805	858	749

Appendix Table 5. Continued

Midpoint of fork length interval (mm)	Commercial Hook and Line 1979 Jan M	Jan F	Jan U	Mar M	Mar F	Gill Net 1968 Jan M	Jan F
	Number of fish						
349		1					
449							
549	16	18	1				
649	76	109	5	10	15	54	14
749	84	94	3	16	30	151	192
849	30	80	3	7	33	116	163
949	2	36			6	34	54
1049	1	7			1	6	32
1149							16
1249		1					1
1349							1
Total	209	346	12	33	85	361	473
Mean Length	715	757	716	740	788	790	839

	Gill Net 1968 Feb M	Feb F	Mar M	Mar F	Apr M	Apr F	Nov M	Nov F
	Number of fish							
549	2		1			2		
649	199	66	94	29	2	2		
749	438	540	198	230	3	6	1	
849	148	184	119	197		2	1	2
949	5	24	41	75		1		1
1049		2	7	36				
1149				11				
Total	792	816	460	578	5	13	2	3
Mean Length	743	770	776	830	709	734	799	882

Appendix Table 5. Continued

Midpoint of fork length interval (mm)	Gill Net								
	1969				1976	1977			1978
	Mar		Apr		Feb	Jan	Feb	Mar	Apr
	M	F	M	F	U	U	U	U	U
	Number of fish								
549						3			
649		1	3		40	370	58	17	83
749	3	2	4	4	230	1134	502	82	849
849	3	6	3	4	42	807	393	61	364
949	2	2		3	1	347	98	55	9
1049				1		96	7	57	
1149		1				12	3	26	
1249						8	1	7	
1349								1	
Total	8	12	10	12	313	2777	1062	306	1305
Mean Length	837	857	749	857	750	803	803	903	772

Appendix Table 6. Length-frequency distributions of king mackerel caught off South Carolina and Georgia, 1978 (M = male, F = female, U = sex unknown).

Midpoint of fork length interval (mm)	Recreational Hook and Line 1978								
	Aug		Sep			Oct		
	F	U	M	F	U	M	F	U
	Number of fish							
549			1		4	21	21	4
649		1			1	5	16	
749		1	1		9	59	52	2
849	3				53	58	87	
949		2		1	39	10	37	
1049		3			16	3	23	
1149					5		9	
1249							2	
1349							1	
Total	3	7	2	1	127	156	248	6
Mean Length	849	920	649	949	899	775	839	616

Appendix Table 7. Length-frequency distributions of king mackerel caught off North Carolina, 1977-78 (M = male, F = female, U = sex unknown).

Midpoint of fork length interval (mm)	Recreational Hook and Line								
	1977					1978		
	May	Jun	Jul			May		
	U	U	M	F	U	M	F	U
	Number of fish							
549	6							
649	21	10	1	3	3	5	3	1
749	15	13			2	6	8	2
849	3	4			3	2	19	1
949		1	1	1	3		11	
Total	45	28	2	4	11	13	41	4
Mean Length	682	735	799	724	804	726	842	749

	Recreational Hook and Line								
	1978								
	Jun			Jul			Aug		
	M	F	U	M	F	U	M	F	U
	Number of fish								
549							1		
649	1	6	6					1	
749	1	5	9		3				1
849		4	4	2	8	3	2	5	
949		4	2		2	1		8	
1049			1					2	
1149			2						1
Total	2	19	24	2	13	4	3	16	2
Mean Length	699	781	803	849	841	874	749	912	949

Appendix Table 7. Continued

Midpoint of fork length interval (mm)	Recreational Hook and Line 1978 Sep M	Sep F	Sep U	Oct M	Oct F	Oct U	Nov F	Nov U
	Number of fish							
549	1	1	8		1			
649			4		1	2		1
749		1	24	34	48	24		1
849	2	21	37	62	117	47		4
949	2	18	14	6	62	3	2	
1049		7	4	1	21	4	4	
1149					5	2	4	
1249					1			
Total	5	48	91	103	256	82	10	6
Mean Length	829	907	812	824	876	836	1069	799

	Commercial Hook and Line 1978 Sep U	1978 Oct U	1979 May U[1/]	1979 May U[2/]	1979 May U[3/]
	Number of fish				
549	7				
649	4	2	21	5	
749	19	10	9	55	42
849	29	19	4	24	389
949	11	2	1	7	201
1049	2	2			39
1149		1			10
1249					2
Total	72	36	35	91	683
Mean Length	804	836	703	784	887

1/ 10-11 Fathoms
2/ 12-17 Fathoms
3/ 18-30 Fathoms